FINAL

KC-46A FORMAL TRAINING UNIT (FTU) AND FIRST MAIN OPERATING BASE (MOB 1) BEDDOWN EIS

Prepared for:
Air Force Civil Engineer Center
Air Mobility Command
Air Education and Training Command
United States Air Force

VOLUME II

March 2014

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
ACM	asbestos-containing material
AFB	Air Force Base
AFI	Air Force Instruction
AFW	Fort Worth Alliance Airport
AGE	aerospace ground equipment
AGL	above ground level
AHAS	Avian Hazard Advisory System
AICUZ	Air Installation Compatible Use Zone
AMC	Air Mobility Command
ANSI	American National Standards Institute
APE	area of potential effect
APZ	accident potential zone
AT/FP	Anti-Terrorism/Force Protection
BGEPA	Bald and Golden Eagle Protection Act
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CH_4	methane
CHABA	Committee on Hearing, Bioacoustics and Biomechanics
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
CSM	Clinton-Sherman Industrial Airpark
CWA	Clean Water Act
CZ	clear zone
dB	decibel(s)
dBA	A-weighted decibel
DNL	day-night average sound level
DoD	U.S. Department of Defense
DODI	Department of Defense Instruction
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FICAN	Federal Interagency Committee on Aircraft Noise
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
FTU	Formal Training Unit
GHG	greenhouse gases
GMV	government motor vehicle
GWP	global warming potential
HAP	hazardous air pollutant
Hz	hertz
ICRMP	Integrated Cultural Resources Management Plan
IMPLAN	Impact Analysis for Planning

ACRONYMS AND ABBREVIATIONS (Continued)

LAX	Los Angeles International Airport
LBP	lead-based paint
LEED	Leadership in Energy and Environmental Design
MOB 1	First Main Operating Base
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIPTS	Noise-Induced Permanent Threshold Shift
NLR	noise level reduction
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NRHP	National Register of Historic Places
O_3	ozone
ODS	ozone depleting substance
PCB	polychlorinated biphenyl
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
POV	privately owned vehicle
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTS	Permanent Threshold Shift
ROI	region of influence
SEL	sound exposure level
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
TTS	Temporary Threshold Shift
U.S.C.	*United States Code*
UCLA	University of California, Los Angeles
UFC	Unified Facilities Criteria
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

APPENDIX A

CORRESPONDENCE

This Appendix is contained on the CD-ROM on the back cover of this document.

APPENDIX B

DEFINITION OF RESOURCE AND METHODOLOGY FOR ANALYSIS

APPENDIX B DEFINITION OF RESOURCE AND METHODOLOGY FOR ANALYSIS

This appendix directly corresponds to the environmental resource areas described in Volume I, Chapter 3, as the baseline conditions, and the analysis of consequences, as described in Volume I, Chapter 4, for each of the four bases under consideration. The environmental resource areas are ordered according to the order in Volume I, Chapters 3 and 4. For each environmental resource area, this appendix provides a definition of the resource, the regulatory setting, if applicable, and a description of the methodology used to evaluate the environmental resource area.

Because the same resource areas were analyzed for each of the four bases, the definition, regulatory setting, and methodology are the same for all four bases. The analysis methodology addresses both the context of the environmental resource and the intensity of potential consequences to the resource resulting from implementation of the KC-46A missions.

B.1 NOISE

B.1.1 RESOURCE DEFINITION

Sound is tiny vibrations in a medium such as air or water that are detected by the ear. Noise is specifically unwanted sound or, alternatively, a lack of ‘peace and quiet.’ There is a wide variety of types of noises. Reactions to noises depend not only on the qualities of the noise (e.g., intensity, pitch, duration, or time of day) but also on the characteristics of the listener (e.g., sensitivity of the individual and attitude toward the noise source) and the activity in which the listener is engaged at the time the noise occurs.

B.1.2 REGULATORY SETTING

Since legal limits on allowable noise levels could, in some cases, reduce the combat effectiveness of military equipment, military equipment has been exempted from regulations that impose noise limitations. However, several policies and regulations are in place to limit the effects of military noise.

The U.S. Air Force (USAF) recognizes that noise-sensitive land uses are not compatible with elevated aircraft noise levels and has implemented the Air Installation Compatible Use Zone (AICUZ) program, as described in Air Force Instruction (AFI) 32-7063 and Department of Defense Instruction (DoDI) 4165.57, to minimize incompatible land use. In 1992, the Federal Interagency Committee on Noise (FICON) established a set of guidelines detailing which land uses are compatible at which noise levels; these guidelines have been adopted as part of the AICUZ program.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise (FICUN) published guidelines (FICUN 1980) relating day-night average sound level (DNL) to compatible land uses. The FICUN guidelines consider areas with noise levels of 75 decibels (dB) DNL or greater as unacceptable living environments. Areas between 65–74 dB DNL are considered “generally unacceptable” for noise-sensitive land uses such as residences, schools, hospitals, and public services. Houses located in areas between 65–74 dB DNL may not qualify for Federal mortgage insurance without additional costs associated with installing noise attenuation. In the outdoor noise environment, levels greater than 65 dB DNL may be annoying to some people during communications. Generally, residential development is not recommended in areas experiencing noise levels of 65 A-weighted decibels (dBA) or greater. Although discouraged, residential development is compatible within the 65–69 dBA and 70–74 dBA contours, provided noise

reduction levels of 25 dB and 30 dB, respectively, are achieved. Commercial/retail businesses are compatible without restrictions up to 69 dBA, and up to 79 dBA, provided that noise reduction levels of 25 dB and 30 dB, respectively, are achieved for public areas. Industrial/manufacturing, transportation, and utility companies have a high noise level compatibility, and, therefore, can be located within the higher noise zones. Additional discussion of the relationship between land use and noise can be found in Volume I, Chapter 3, Sections 3.1.7, 3.2.7, 3.3.7, and 3.4.7, which are the land use sections for each of the four bases.

On-base noise exposure to workers may exceed 80 dB DNL. Workers in known high noise exposure locations may be required to wear hearing protection devices including, but not limited to, earplugs and earmuffs. The hearing conservation programs at each base are conducted in accordance with Air Force Occupational Safety and Health Standard 48-20, "Occupational Noise and Hearing Conservation Program," DoDI 6055.12, "DoD Hearing Conservation Program," and Title 29 of the *Code of Federal Regulations* (CFR) Section 1910.95, "Occupational Noise Exposure." The Bioenvironmental Engineering Office administers the Hearing Conservation Program at each of the candidate bases. Representatives from the Bioenvironmental Engineering Office visit facilities in which workers could potentially be exposed to noise levels exceeding noise exposure thresholds. A health risk assessment is conducted involving dosimeter testing of a representative sample of employees. An audiometric monitoring program is initiated if noise exposure exceeds established thresholds.

Per U.S. Department of Defense (DoD) policy, the 80 dB DNL noise contour is used to identify populations most at risk of potential hearing loss (USD 2009). If no residence or populated area is within the 80 dB DNL contour, then no further risk assessment is warranted. No residences or populated areas are within the 80 dB DNL noise contours for any of the four candidate locations. Therefore, Potential Hearing Loss risk assessment was not warranted.

B.1.3 METHODOLOGY

B.1.3.1 Base Vicinity

Noise levels in the vicinity of the Formal Training Unit (FTU) and First Main Operating Base (MOB 1) bases were modeled using NOISEMAP Version 7.2. In accordance with current USAF policy, NOISEMAP runs were conducted using the topographic effects module. This module accounts for the effects of local terrain and ground surface type on the propagation of sound.

The areas exposed to elevated noise levels are shown using DNL noise contours at 5 dB increments from 65 dB to 85 dB. Elevated DNL implies that overflight noise is particularly frequent and intense. In general, noise levels are highest on and near the airfield itself and decrease with distance from the airfield. However, in a few instances, the overlapping of two or more flight paths generates a geographically separated area in which noise exceeds 65 DNL. These instances appear as small noise contour polygons separated from the larger noise contour set.

The number of off-base persons exposed to noise level increments was estimated using 2010 U.S. Census data. Noise contours were overlaid on census blocks to determine the fraction of each census block that lies within each noise level increment. Census block population was apportioned to inside or outside of the noise level increment based on the fraction of the census block affected. This method assumes even distribution of population with the census block. The U.S. Census counts permanent residents; non-permanent residents are not counted using this method.

B.1.3.2 Auxiliary Airfields

Aircrews associated with the KC-46A FTU scenario would make use of auxiliary airfields to provide aircrews with varied training experiences. The auxiliary airfields proposed for regular use by the KC-46A FTU are heavily used under baseline conditions. At each auxiliary airfield proposed for use, the current level of operations was compared against proposed additional operations to determine potential DNL increase.

KC-46A operations at auxiliary airfields would be expected to use the same procedures being used by other aircraft at the airfields currently. The KC-46A would be expected to overfly the same ground areas, use the same pattern altitudes, and conform to the same runway usage patterns as current operations. To ensure that the noise level increase threshold of 0.5 dB DNL would not be exceeded as a result of temporary or longer-term increases in KC-46A operations tempo, a mission evolution factor was applied. The mission evolution factor chosen was 150 percent of proposed averaged KC-46A operations. In calculation of the DNL metric, noise events occurring between 10:00 P.M. and 7:00 A.M. are assessed a 10 dB penalty. As a result, an aircraft operation occurring between 10:00 P.M. and 7:00 A.M. has the same effect on cumulative DNL as 10 of the same operations occurring during other time periods. The KC-46A would not be expected to conduct operations at auxiliary airfields between 10:00 P.M. and 7:00 A.M.

Each aircraft type operating at the auxiliary airfields was categorized as being either "as loud or louder than a KC-46A" or "less loud than a KC-46A" based on comparison of noise level at a 1,000-foot distance and a standard aircraft configuration type. In calculation of potential DNL change, all aircraft classified as "loud or louder" than a KC-46A were treated as if they were exactly as loud as a KC-46A and aircraft "less loud than a KC-46A" were disregarded. This approach generates conservative results. The potential DNL increase was calculated using the formula below, and results are shown in Table B-1.

$$\mathbf{DNL_{increase} = 10\ LOG\ (N_{day\ KC46} + [10*N_{night\ KC46}]) - 10\ LOG\ (N_{day\ existing} + [10*N_{night\ existing}])}$$

Table B-1. Calculation of Potential DNL Increase

Base	Proposed KC-46A[a]		Existing			Conclusion	
	Annual Airfield Operations	Annual Operations After Mission Evolution Factor	Existing Annual Operations	Percent Existing Operations as Loud or Louder than KC-46	Percent 2200-0700 (Aircraft Types as Loud or Louder)	DNL Change Not Expected to Be Exceeded	Requires Further Analysis (Yes/No [Y/N])
Altus AFB FTU Scenario Auxiliary Airfields							
AMA	517	776	54,115	31%	3%	0.15	N
CSM	3,681	5,522	28,485	92%	3%	0.66	Y
AFW	2,170	3,255	100,756	12%	15%	0.45	N
LBB	148	222	67,919	25%	4%	0.04	N
McConnell AFB FTU Scenario Auxiliary Airfields							
CSM	977	1,466	28,485	92%	3%	0.18	N
FOE	977	1,466	24,742	73%	11%	0.18	N
ITC	4,561	6,842	165,035	34%	11%	0.26	N

[a] No KC-46A operations would be conducted at night (10:00 P.M. to 7:00 A.M.).

Key: AMA= Rick Husband Amarillo International Airport; AFW= Fort Worth Alliance Airport; CSM= Clinton-Sherman Industrial Airpark; FOE= Forbes Field; ICT= Wichita Mid-Continental Airport; LBB=Lubbock Preston Smith International Airport

As shown in the Table B-1, the potential DNL increase would exceed 0.5 dB only at Clinton-Sherman Industrial Airpark (CSM) under the Altus Air Force Base (AFB) FTU scenario. Increases of less than 0.5 dB would not be expected to be noticed by people near the airfield, and noise impacts would be minimal. No further noise analysis was conducted at these locations.

B.2 AIR QUALITY

B.2.1 RESOURCE DEFINITION

Air quality in a given location is defined by the size and topography of the air basin, the local and regional meteorological influences, and the types and concentrations of pollutants in the atmosphere. The significance of a pollutant concentration often is determined by comparing its concentration to an appropriate national or state ambient air quality standard. These standards represent the allowable atmospheric concentrations at which the public health and welfare are protected and include a reasonable margin of safety to protect the more sensitive individuals in the population. The U.S. Environmental Protection Agency (USEPA) established the National Ambient Air Quality Standards (NAAQS) to regulate the following criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead. The NAAQS generally may not be exceeded more than once per year, except for annual standards, which may never be exceeded. Units of concentration for these standards generally are expressed in parts per million (ppm) or micrograms per cubic meter (µg/m^3). Table B-2 presents the NAAQS.

Table B-2. National Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards	
		Primary[a, b]	Secondary[a, c]
Ozone	8-hour	0.075 ppm (147 µg/m^3)	Same as primary
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)	–
	1-hour	35 ppm (40 mg/m^3)	–
Nitrogen dioxide	Annual	0.053 ppm (100 µg/m^3)	Same as primary
	1-hour	0.10 ppm (188 µg/m^3)	–
Sulfur dioxide	3-hour	–	0.5 ppm (1,300 µg/m^3)
	1-hour	0.075 ppm (105 µg/m^3)	–
PM_{10}	24-hour	150 µg/m^3	Same as primary
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3
	24-hour	35 µg/m^3	35 µg/m^3
Lead	Rolling 3-month period	0.15 µg/m^3	Same as primary

[a] Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.
[b] Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
[c] Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

The NAAQS 8-hour O_3 standard is attained when the measured average of the annual fourth-highest daily maximum 8-hour average concentration is less than or equal to 0.075 ppm. For CO and PM_{10}, the NAAQS are not to be exceeded more than once per year. The NAAQS annual NO_2 standard is attained when the annual arithmetic mean concentration in a calendar year is less than or equal to 0.053 ppm. The 1-hour NO_2 standard is attained when the 3-year average of the 98th percentile of the daily maximum 1-hour average concentration does not exceed 0.10 ppm. For SO_2, the primary NAAQS is attained if the 1-hour concentration is less than or equal to 0.075 µg/m^3. The NAAQS $PM_{2.5}$ standards are attained when the annual arithmetic mean concentration is less than or equal to 12 µg/m^3 and when the 98th percentile of 24-hour concentration is less than or equal to 65 µg/m^3.

O_3 concentrations are the highest during the warmer months of the year and coincide with the period of maximum insolation. Maximum O3 concentrations tend to be homogeneously spread throughout a region, as it often takes several hours to convert precursor emissions to O_3 (mainly nitrogen oxides [NO_x] and photochemically reactive volatile organic compounds [VOCs]) in the atmosphere. Inert pollutants, such as CO, tend to have the highest concentrations during the colder months of the year, when light winds and nighttime/early morning surface-based temperature inversions inhibit atmospheric dispersion. Maximum inert pollutant concentrations are usually found near an emission source.

B.2.1.1 Greenhouse Gases

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions are generated by both natural processes and human activities. The accumulation of GHGs in the atmosphere regulates the earth's temperature. The U.S. Global Change Research Program report, *Global Climate Change Impacts in the United States*, states the following:

- Observations show that warming of the climate is unequivocal. The global warming observed over the past 50 years is due primarily to human-induced emissions of heat-trapping gases. These emissions come mainly from the burning of fossil fuels (coal, oil, and gas), with important contributions from the clearing of forests, agricultural practices, and other activities.
- Warming over this century is projected to be considerably greater than over the last century. The global average temperature since 1900 has risen by about 1.5 degrees Fahrenheit (^{o}F). By 2100, it is projected to rise another 2 ^{o}F to 11.5 ^{o}F. The U.S. average temperature has risen by a comparable amount and is very likely to rise more than the global average over this century, with some variation from place to place. Several factors will determine future temperature increases. Increases at the lower end of this range are more likely if global heat-trapping gas emissions are cut substantially. If emissions continue to rise at or near current rates, temperature increases are more likely to be near the upper end of the range. Volcanic eruptions or other natural variations could temporarily counteract some of the human-induced warming, slowing the rise in global temperature, but these effects would only last a few years.
- Reducing emissions of carbon dioxide (CO_2) would lessen warming over this century and beyond. Sizable early cuts in emissions would significantly reduce the pace and the overall amount of climate change. Earlier cuts in emissions would have a greater effect in reducing climate change than comparable reductions made later. In addition, reducing emissions of some shorter-lived heat-trapping gases, such as methane (CH_4), and some types of particles, such as soot, would begin to reduce warming within weeks to decades.

- Climate-related changes have already been observed globally and in the United States. These include increases in air and water temperatures, reduced frost days, increased frequency and intensity of heavy downpours, a rise in sea level, and reduced snow cover, glaciers, permafrost, and sea ice. A longer ice-free period on lakes and rivers, lengthening of the growing season, and increased water vapor in the atmosphere have also been observed. Over the past 30 years, temperatures have risen faster in winter than in any other season, with average winter temperatures in the Midwest and northern Great Plains increasing more than 7 ºF. Some of the changes have been faster than previous assessments had suggested.
- These climate-related changes are expected to continue while new ones develop. Likely future changes for the United States and surrounding coastal waters include more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of these storms that make landfall), as well as drier conditions in the Southwest and Caribbean. These changes will affect human health, water supply, agriculture, coastal areas, and many other aspects of society and the natural environment. (USGCRP 2009).

GHGs include water vapor, CO_2, CH_4, nitrous oxide, O_3, and several hydrocarbons and chlorofluorocarbons. Each GHG has an estimated global warming potential (GWP), which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the earth's surface relative to CO_2. The GWP of CO_2 is 1, and is, therefore, the standard by which all other GHGs are measured. GHGs are often reported as carbon dioxide equivalent (CO_{2e}), which is used to express emissions of GHG relative to emissions of CO_2.

The potential effects of GHG emissions from the project scenarios are by nature global. Given the global nature of climate change and the current state of the science, it is not useful at this time to attempt to link the emissions quantified for local actions to any specific climatological change or resulting environmental impact. Nonetheless, the GHG emissions from the project scenarios have been quantified to the extent feasible in this Final Environmental Impact Statement (EIS) for information and comparison purposes.

B.2.1.2 Ozone Depleting Substances

The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer prohibited production of all Class I ozone depleting substances (ODSs) in signatory countries by 1996. The Clean Air Act (CAA) amendments of 1990 govern the consumption, transportation, use, and disposal of ODSs. Section 326 of the fiscal year 1993 National Defense Authorization Act requires Senior Acquisition Official approval for contracts requiring use of ODSs. The KC-46A will be the first Air Mobility Command (AMC) aircraft to be completely free of ODSs. The USAF-approved halon alternative is HSC-125. Handheld extinguishers used in the KC-46A also will be ODS-free, whereas commercial aircraft use ODS for all fire suppression systems.

B.2.2 REGULATORY SETTING

The CAA and its subsequent amendments establish air quality regulations and the NAAQS and delegate the enforcement of these standards to the states. The CAA establishes air quality planning processes and requires areas in nonattainment of an NAAQS to develop a State Implementation Plan (SIP) that details how the state will attain the standard within mandated timeframes. The requirements and compliance dates for attainment are based on the severity of the nonattainment classification of the area. The following summarizes the air quality rules and regulations that apply to the project scenarios.

B.2.2.1 Federal Regulations

CAA Section 176(c) and USEPA's General Conformity implementing regulation generally prohibit federal agencies from engaging in, supporting, permitting, or approving any activity that does not conform to the most recent USEPA-approved SIP in nonattainment or maintenance areas. This means that federal projects in such areas or other activities using federal funds or requiring federal approval (1) will not cause or contribute to any new violation of an NAAQS; (2) will not increase the frequency or severity of any existing violation; or (3) will not delay the timely attainment of any standard, interim emission reduction, or other milestone. CAA Section 176(c) (42 U.S. Code [USC] 7506(c)) and 40 CFR Part 93, Subpart B, implement the USEPA General Conformity Rule.

The General Conformity Rule applies to Federal actions affecting areas that are in nonattainment of an NAAQS and to designated maintenance areas (attainment areas that have been reclassified from a previous nonattainment status and are required to prepare an air quality maintenance plan). Conformity requirements only apply to nonattainment and maintenance pollutants and their precursor emissions. Conformity determinations are required when the annual direct and indirect emissions from a proposed Federal action equal or exceed an applicable *de minimis* threshold. These thresholds vary by pollutant and the severity of nonattainment conditions in the region affected by the proposed action. The General Conformity Rule applies to proposed KC-46A operations within the following project regions: (1) for actions proposed at Altus AFB, the serious O_3 nonattainment area that encompasses the Fort Worth Alliance Airport (AFW) auxiliary airfield and (2) for actions proposed at Fairchild AFB, the Spokane CO and PM_{10} maintenance areas, about 4 miles east of the eastern portion of Fairchild AFB. Proposed KC-46A operations within these areas would conform to the applicable SIP if their annual emissions remain below (1) 50 tons per year of VOCs or NO_x for the AFW auxiliary airfield and (2) 100 tons per year of CO and PM_{10} for the Spokane area.

Under the CAA, state and local agencies may establish air quality standards and regulations of their own, provided these are at least as stringent as the Federal requirements. These state and local standards and regulations are described in the affected environment sections for each base in Volume I, Chapter 3 (see Sections 3.1.2, 3.2.2, 3.3.2, and 3.4.2). In addition, Table B-3 presents state ambient air quality standards promulgated by the Washington Department of Ecology and North Dakota Department of Health.

B.2.2.2 Greenhouse Gases

The USEPA has promulgated several final regulations involving GHGs either under the authority of the CAA, or as directed by Congress, but none of them apply directly to the project scenarios. On 18 February 2010, the Council on Environmental Quality (CEQ) released its *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* (CEQ 2010), which suggests that proposed actions that would be reasonably anticipated to emit 25,000 metric tons or more per year CO_{2e} should be evaluated by quantitative and qualitative assessments. This is not a threshold of significance, but rather an indicator that a quantitative and qualitative assessment should be included in the NEPA documentation. The purpose of quantitative analysis of CO_{2e} emissions in this Final EIS is for its potential usefulness in making reasoned choices among scenarios.

Table B-3. Washington and North Dakota Ambient Air Quality Standards

Pollutant	Averaging Time	State Standards	
		Washington	North Dakota
Ozone	8-hour		0.075 ppm (147 µg/m^3)
	1-hour	0.12 ppm (235 µg/m^3)	
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	1-hour	35 ppm (40 mg/m^3)	35 ppm (40 mg/m^3)
Nitrogen dioxide	Annual	0.05 ppm (100 µg/m^3)	0.05 ppm (100 µg/m^3)
	1-hour		0.10 ppm (188 µg/m^3)
Sulfur dioxide	Annual	0.02 ppm	
	24-hour	0.10 ppm	
	3-hour		0.5 ppm (1,300 µg/m^3)
	1-hour	0.40 ppm[a]	
	1-hour	0.25 ppm[b]	0.075 ppm (196 µg/m^3)
PM_{10}	Annual	50 µg/m^3	
	24-hour	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual		15 µg/m^3
	24-hour		35 µg/m^3
Total Suspended Particulates	Annual	60 µg/m^3	
	24-hour	150 µg/m^3	
	Annual[c]	0.02 ppm 28 µg/m^3	
	24-hour	0.1 ppm 140 µg/m^3	
	1-hour[d]	0.2 ppm 280 µg/m^3	
	Instantaneous	10 ppm (14 mg/m^3)	

[a] Not to be above this level more than once in a calendar year.
[b] Not to be above this level more than twice in a consecutive 7-day period.
[c] Maximum arithmetic mean concentration averaged over 3 consecutive months.
[d] Not to be exceeded more than once per month.

B.2.3 METHODOLOGY

The air quality analysis estimated the magnitude of emissions that would occur from proposed KC-46A construction and operational activities at each proposed base location. Depending on the project scenario, the estimation of proposed operational impacts is based on (1) the net increase in emissions due to the addition of KC-46A aircraft or (2) the net change in emissions due to the replacement of existing KC-135 operations with operations from the beddown of KC-46A aircraft.

Potential impacts on air quality are evaluated with respect to the extent, context, and intensity of the impact in relation to relevant regulations, guidelines, and scientific documentation. The CEQ defines significance in terms of context and intensity in 40 CFR Section 1508.27. This requires that the significance of an action must be analyzed in respect to the setting of the action and based relative to the severity of the impact. The CEQ NEPA regulations (40 CFR 1508.27(b)) provide 10 key factors to consider in determining the intensity of an impact.

In the case of criteria pollutants for which the project region is in attainment of an NAAQS, the analysis compared the net increase in annual air pollutant emissions estimated for each project scenario to the USEPA Prevention of Significant Deterioration (PSD) threshold for new major sources of 250 tons per year of a pollutant as an indicator of significance or non-significance of projected air quality impacts. In the case of criteria pollutants for which the project region does not attain an NAAQS, the analysis compared the net increase in proposed annual emissions to the applicable pollutant threshold that requires a conformity determination for that region.

If proposed emissions exceed a PSD or conformity threshold, further analysis was conducted to determine whether impacts were significant. In such cases, if proposed emissions (1) do not contribute to an exceedance of an ambient air quality standard or (2) conform to the approved SIP, then impacts would be less than significant.

B.2.3.1 Construction

The KC-46A project scenarios at each proposed basing location would require construction and/or renovation of airfield facilities, including training facilities, hangars, taxiways, and maintenance and fueling facilities. Air quality impacts due to proposed construction activities would occur from (1) combustive emissions due to the use of fossil fuel-powered equipment and (2) fugitive dust emissions (PM_{10}/$PM_{2.5}$) due to the operation of equipment on exposed soil. Construction activity data were developed to estimate proposed construction equipment usages and associated combustive and fugitive dust emissions for each project scenario.

Factors needed to derive construction source emission rates were obtained from the *Compilation of Air Pollutant Emission Factors*, AP-42, Volume I (USEPA 1995); the USEPA NONROAD2008a model for nonroad construction equipment (USEPA 2009); and the USEPA MOVES2010b model for on-road vehicles (USEPA 2013).

Inclusion of standard construction practices and Leadership in Energy and Environmental Design (LEED) Silver certification into proposed construction activities would potentially reduce fugitive dust emissions generated from the use of construction equipment on exposed soil by 50 percent from uncontrolled levels. The standard construction practices for fugitive dust control include the following:

1. Use water trucks to keep areas of vehicle movement damp enough to minimize the generation of fugitive dust.
2. Minimize the amount of disturbed ground area at a given time.
3. Suspend all soil disturbance activities when winds exceed 25 miles per hour or when visible dust plumes emanate from the site and stabilize all disturbed areas with water application.
4. Designate personnel to monitor the dust control program and to increase watering, as necessary, to minimize the generation of dust.

B.2.3.2 Operations

Sources associated with operation of the proposed KC-46A scenarios at each basing location would include (1) operations and engine maintenance/testing of aircraft, (2) onsite privately owned vehicles (POVs) and government motor vehicles (GMVs), (3) offsite POV commutes, (4) aerospace ground equipment (AGE), (5) nonroad mobile equipment, (6) mobile fuel transfer operations, and (7) stationary and other sources. Operational data used to calculate projected KC-46A aircraft emissions were obtained from data used in the project noise analyses. Factors used to calculate combustive emissions for the KC-46A aircraft are based on emissions data developed by Pratt and Whitney for the PW4062 engine (ICAO 2013). The operational times in mode for the KC-46A engine are based on those for the KC-135 aircraft (Air Force Civil Engineer Center 2013).

Emissions from non-aircraft sources due to the proposed KC-46A scenarios at each basing location were estimated by the following methods:

1. Emissions from the usage of AGE by KC-46A aircraft at Altus AFB are based on AGE usages for existing C-17 and KC-135 aircraft at Altus AFB. Emissions from the usage of AGE by KC-46A aircraft at all other base locations are based on AGE usages for existing KC-135 aircraft at Fairchild AFB.
2. Emissions from POVs, GMVs, and stationary sources were estimated by multiplying existing emissions generated at each base for these sources by the ratio of total base employment populations associated with each proposed scenario and baseline conditions.
3. The emission estimations for AGE, POVs, GMVs, and nonroad equipment simulated the gradual turnover of these sources in the future to vehicle and equipment fleets with new and cleaner USEPA emission standards.
4. Emissions from mobile fuel transfer operations were estimated by multiplying existing emissions for this source at Altus AFB by the ratio of total base employment populations associated with each proposed scenario and baseline conditions at Altus AFB.

The air quality analysis uses calendar year 2012 to define existing emissions, as it includes the most recent calendar year of operational activities at each basing location.

The analysis of proposed aircraft operations is limited to operations that occur within the lowest 3,000 feet (914 meters) of the atmosphere, as this is the typical depth of the atmospheric mixing layer where the release of aircraft emissions would affect ground-level pollutant concentrations. In general, aircraft emissions released above the mixing layer would not appreciably affect ground-level air quality.

B.3 SAFETY

B.3.1 RESOURCE DEFINITION

Ground and flight safety involving aviation operations conducted by the USAF are addressed in this section. Because of the proposal to construct within portions of the airfield environment, the focus of this section is on safety-of-flight issues associated with airfield operations. Within the ground safety section, issues involving operations and maintenance (O&M) activities that support operation of the airfield are addressed. Also considered in this section is the safety of personnel and facilities on the ground that may be placed at risk from flight operations. Within the aircraft mishaps/flight safety section for each base, aircraft flight risks and safety issues associated with conducting aviation activities at the respective bases are addressed. Historic information on aircraft accidents for the

KC-135 at each base is also presented to give the reader perspective as to the frequency of major mishaps, which occurred during the lengthy service of the existing tanker aircraft.

KC-46A flight risks and safety issues associated with conducting aviation activities at the base and in the near-base airspace are addressed. Any KC-46A accidents at the airfield would have direct impacts on the ground in the immediate vicinity of the mishap as a result of explosion/fire and debris spread.

B.3.2 REGULATORY SETTING

Numerous Federal, civil, and military laws and regulations govern operations at bases and in the surrounding airspace. Individually and collectively, they prescribe measures, processes, and procedures required to ensure safe operations and to protect the public, military, and property.

B.3.3 METHODOLOGY

A variety of elements associated with implementation of the KC-46A scenarios at any of the four bases that could potentially affect safety are evaluated relative to the degree to which the action increases or decreases safety risks to the public or private property. Flight and ground safety are assessed for the potential to increase risk and the capability to manage that risk by responding to emergencies.

Impacts to safety are assessed according to the potential to increase or decrease in safety risks to personnel, the public and property. The development activities associated with the proposed KC-46A missions are considered to determine whether additional or unique safety risks are associated with its undertaking. If any activity associated with the KC-46A scenarios indicates a major variance from baseline conditions, it would be considered a significant safety impact.

B.3.3.1 Flight Safety

The primary public concern with regard to flight safety is the potential for aircraft accidents. Such mishaps may occur as a result of mid-air collisions, collisions with man-made structures or terrain, weather-related accidents, mechanical failure, pilot error, or bird-aircraft collisions. Collisions with structures around the airfield are controlled through airfield setbacks and safety zones that restrict construction around the airfield so that both the ground surface is clear for ground maneuvering and the airspace is clear of obstructions such as groves of trees, poles and power lines, and tall structures. The AICUZ defines the accident potential zones (APZs) around the airfield and prescribes restrictions on any construction in the clear zone (CZ) (see Figure B-1). Land use restrictions are recommended for APZs I and II, based mostly on the intensity of use. That is, activities where people congregate are not recommended, and uses where people spend a high percentage of time (such as residential) are also not recommended.

The USAF defines five major categories of aircraft mishaps: Classes A, B, C, D, and E, which includes high accident potential. Class A mishaps result in a loss of life, permanent total disability, a total cost in excess of $2 million, and/or destruction of an aircraft. Class B mishaps result in permanent partial disability or inpatient hospitalization of three or more personnel and/or a total cost of between $500,000 and up to $2 million. Class C mishaps involve an injury resulting in any loss of time from work beyond the day or shift on which it occurred, an occupational illness that causes loss of time from work at any time, or an occupational injury or illness resulting in permanent change of job and/or reportable damage of between $50,000 and up to $500,000. High accident potential events are any hazardous occurrence that has a high potential for becoming a mishap. Class C mishaps and high accident potential, the most common types of accidents, represent relatively unimportant incidents because they generally involve minor damage and injuries, and rarely affect property or the public.

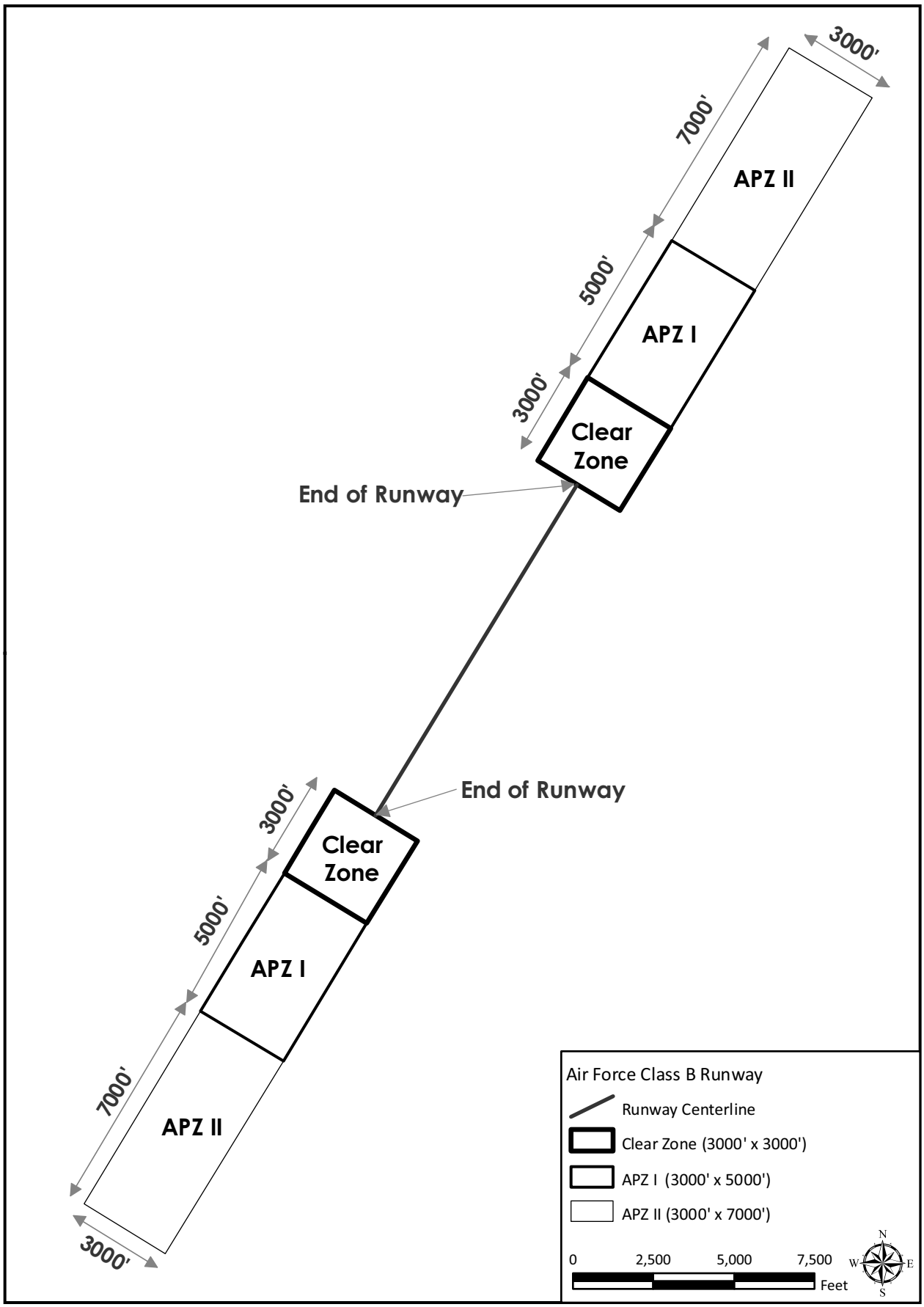

Figure B-1. Air Force Clear Zone and Accident Potential Zones for Class B Runways

Class D mishaps result in total cost of property damage of $20,000 or more, but less than $50,000; or a recordable injury or illness not otherwise classified as a Class A, B, or C mishap. Note that in 2010, the threshold for determining the class of mishaps was raised from $1 to $2 million for Class A mishaps, and the ceiling was raised for Class B from $1 million to $2 million.

Accident rates for commercial aircraft are determined using accidents per million departures (or flight cycles) since there is a stronger statistical correlation between accidents and departures than there is between accidents and flight hours, between accidents and the number of airplanes in service, or between accidents and passenger miles or freight miles.

This Final EIS focuses on USAF Class A mishaps because of their potentially catastrophic results. Based on historical data on mishaps at all bases, and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory. Mishap rates do not consider combat losses due to enemy action. In evaluating this information, it should be emphasized that data presented are only statistically predictive. The actual causes of mishaps are due to many factors, not simply the amount of flying time of the aircraft. Mishap rates are statistically assessed as an occurrence rate per 100,000 flying hours. For the purposes of this analysis, C-135 aircraft include the RC-135, EC-135, and the KC-135 since they share a common airframe based upon the Boeing 707, as modified for military use. Table B-4 reflects the cumulative annual USAF Class A mishap rates of the C-135 for the periods for which accident records have been established. Cargo and Command and Control type aircraft were included since their Mission-Design-Series are similar. The KC-135 entered service with the USAF in 1957; it is one of six military fixed-wing aircraft with over 50 years of continuous service with its original operator. Since the R model conversion of some of the fleet in the 1990s, the safety record of the KC-135 has been on par with that of any modern airliner.

Table B-4. Air Force Class A Accident History for Selected Models of Transport Modified Mission Design/Code Aircraft

Aircraft	Reporting Period	Accident Rate per 100,000 Hours	Lifetime Hours Flown
C-135[a]	CY57-FY12	0.56	14,753,417
C-141	CY64-FY12	0.32	10,641,974
C-17	FY91-FY12	1.10	2,726,728
C-5	CY68-FY12	1.03	2,531,479
C-10	CY81-FY12	1.03	1,558,325

[a] Includes all variants such as EC and KC types, including EC-135, RC-135, and KC-135
Key: CY = calendar year; FY = fiscal year
Source: AFSC 2013

An aircraft crash is what is known in the probability analysis world as a low probability, high consequence risk. Aircraft are designed to ensure that aircraft accidents are rare events. To minimize these accidents, factors causing or contributing to accidents must be understood and prevented. Previous research has studied accident data to determine these factors. The low rate of accidents, however, makes it difficult to discover repeating patterns of these factors.

Levels of safety for commercial airframes are typically measured by the number of accidents and incidents and their rates. An aircraft accident is defined as an occurrence associated with the operation of an aircraft in which people suffer death or injury, and/or in which the aircraft receives substantial damage.

There have been many scholarly papers written, and complex mathematical calculations developed, to try and predict where and when an aircraft or other low probability, high consequence risk might occur. However, none of these efforts have resulted in a consensus or an agreed upon methodology within the risk assessor community.

The methodology of using accident rates as a predictor of the likelihood of a crash is what is commonly used. The accident rates are based upon accidents per 100,000 hours of flight for military aircraft. For commercial aircraft, in general, this expression is a measure of accidents per million departures.

The accident rates for the KC-46A were determined using the accident rate for the B-767 jetliner, which is currently in service. The accident rate for commercial airliners is based upon departures (flight cycles). With takeoffs assumed to be one-half of the total projected departure airfield operations (see operational data contained in Volume I, Chapter 2), the formula $C_r x A_o = 1/X$ (where C_r = crash rate and A_o = departure airfield operations) shows that the frequency of an accident, even with increased operations, is not likely to occur in the foreseeable future.

While it is counterintuitive, an increase in operation tempo (OPTEMPO) may not result in higher accident rates, and no correlation has been proved or disproved. In a 2002 report to Congress on military aviation safety, the Congressional Research Service concluded, "While no correlation between high OPTEMPO and increased mishaps has been proved, it also hasn't been disproved. A great degree of uncertainty remains. Little is known, for example, of the OPTEMPO effects on maintenance, ammunition, training in country, living conditions, or personnel tempo" (CRS 2002). In other words, there are numerous unpredictable factors that may or may not contribute to an accident.

Bird/Wildlife-Aircraft Strike Hazard (BASH). Bird/wildlife-aircraft strikes constitute a safety concern for the USAF because they can result in damage to aircraft or injury to aircrews or local human populations if an aircraft crashes. Aircraft may encounter birds at altitudes up to 30,000 feet mean sea level (MSL) or higher. However, most birds fly close to the ground. More than 97 percent of reported bird strikes occur below 3,000 feet above ground level (AGL). Approximately 30 percent of bird strikes happen in the airport environment, and almost 55 percent occur during low-altitude flight training (AFSC 2013).

To address the issues of aircraft bird strikes, the USAF has developed the Avian Hazard Advisory System to monitor bird activity and forecast bird strike risks. Using Next Generation Radar (NEXRAD) weather radars and models developed to predict bird movement, the Avian Hazard Advisory System is an online, near real time, geographic information system (GIS) used for bird strike risk flight planning across the continental United States and Alaska. Additionally, as part of an overall strategy to reduce BASH risks, the USAF has developed a Bird Avoidance Model using GIS technology as a key tool for analysis and correlation of bird habitat, migration, and breeding characteristics and is combined with key environmental and man-made geospatial data. The model was created to provide USAF pilots and flight schedulers/planners with a tool for making informed decisions when selecting flight routes. The model was created in an effort to protect human lives, wildlife, and equipment during air operations. This information is integrated into required pilot briefings that take place prior to any sortie.

Fuel Jettison. The KC-46A, like the KC-135 aircraft, has the ability to jettison fuel in cases of emergency and non-emergency situations. Data on historical KC-135 operations show that slightly less than two sorties per thousand resulted in a release of fuel (USAF 2013).

The main environmental concern from fuel released from an aircraft is fuel deposition onto the ground and/or surface waters and any possible negative impacts on human health or natural resources. The results of a definitive study on the fate of jettisoned fuel from large USAF aircraft (such as the KC-135) (Deepti 2003) were used to identify a reasonably conservative ground-level fuel deposition value for the KC-46A. This study used the Fuel Jettison Simulation model developed by the USAF to estimate the ground deposition of fuel from jettison events (Teske and Curbishley 2000). This maximum ground-level fuel deposition value identified for the KC-46A would result in effects that are well below known natural resource and human health thresholds for jet fuel. Therefore, the maximum fuel deposition value expected from the KC-46A would not produce substantial or significant impacts on human or natural resources.

It is the policy of the Air Force Major Commands to follow AFIs or supplement those established AFIs. These policies require that pilots avoid fuel jettison, unless safety of flight dictates immediate jettison. For example, AMC policy, which covers all USAF tanker assets, requires that any fuel released from an aircraft must occur above 20,000 feet AGL (AMC 2004, 2012). Similar policy from AETC covers aircrews during training (AFI 11-2KC-135V3). These policies are designed to minimize potential impacts of fuel jettison events. In view of this, no further analysis is included in this section.

B.3.3.2 Ground Safety

Day-to-day O&M activities conducted at AFBs are performed in accordance with applicable USAF safety regulations, published Air Force Technical Orders, and standards prescribed by Air Force Occupational Safety and Health requirements. These are intended to standardize procedures and practices in all activities on USAF property to reduce occupational risks to government personnel and contractors and to protect other persons that reside on or visit the base or the vicinity of the base.

Anti-Terrorism/Force Protection. Anti-Terrorism/Force Protection (AT/FP) is a security program designed to protect USAF active-duty personnel, civilian employees, family members, and facilities and equipment in all locations and situations. The program is accomplished through the planned and integrated application of anti-terrorism measures, physical security, operations security, and personal protective services. It is supported by intelligence, counterintelligence, and other security programs. In response to terrorist attacks, several regulations have been promulgated to ensure that force protection standards are incorporated into the planning, programming, and budgeting for the design and construction of Military Construction-funded facilities. Unified Facilities Criteria (UFC) 04-010-01, *DoD Minimum Antiterrorism Standards for Buildings* (published in 2003 and updated in 2007) (DoD 2007) establishes minimum standoff distances that must be maintained between several categories of structures and areas that are relatively accessible to terrorists.

The intent of AT/FP and design guidance is to improve security, minimize fatalities, and limit damage to facilities in the event of a terrorist attack. Many military bases, including those under consideration for beddown of the KC-46A, were developed before such considerations became a critical concern. Thus, under current conditions, many units are not able to completely comply with all present AT/FP standards. However, as new construction and modification of facilities occurs, AT/FP standards would be incorporated to the maximum extent practicable.

Construction/Demolition Safety. Short-term safety risks are associated with any demolition and construction activity, including those activities proposed as part of this action. However, adherence to standard safety practices would minimize any potential risks.

Airfield Safety. Accident potential relies on identifying where most accidents have occurred in the past at military airfields (USAF 2002). This approach does not produce accident probability statistics since the question of probability involves too many variables for an accurate prediction model to be developed. The analysis of the history of military aircraft accidents focuses on determining where (within the airfield environments) an accident is likely to occur and estimates the size of the impact area that is likely to result from any single accident. As per DoDI 4165.57, "AICUZ, Ground Obstructions," all structures on the ground have the potential to create hazards to flight. The Federal Aviation Administration (FAA) provides detailed instructions for the marking of obstructions (i.e., paint schemes and lighting) to warn pilots of their presence. Any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet AGL or exceeds any obstruction standard contained in 14 CFR Part 77 should normally be marked and/or lighted. The FAA may also recommend marking and/or lighting a structure that does not exceed 200 feet AGL or 14 CFR Part 77 standards because of its particular location. The obstruction standards in 14 CFR Part 77 are primarily focused on structures in the immediate vicinity of airports and approach and departure corridors from airports (14 CFR 77).

B.4 SOILS AND WATER

B.4.1 RESOURCE DEFINITION

The term "soils" refers to unconsolidated materials formed from the underlying bedrock or other parent material. Soils play a critical role in both the natural and human environment.

Water resources include surface water, groundwater, and floodplains. Surface water resources include lakes, rivers, and streams and are important for a variety of reasons, including economic, ecological, recreational, and human health factors. Groundwater includes the subsurface hydrologic resources of the physical environment; its properties are often described in terms of depth to aquifer or water table, water quality, and surrounding geologic composition.

B.4.2 REGULATORY SETTING

The Clean Water Act (CWA) of 1977 (33 U.S.C. 1251 et seq.) and the USEPA Storm Water General Permit regulate pollutant discharges. Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants, such as biochemical oxygen demand, total suspended solids, fecal coliform, oil and grease, and pH. Wetlands are discussed under the Biological Resources section below.

Federal agencies are also required to comply with Section 438 of the Energy Independence and Security Act of 2007 (EISA) for any project exceeding 5,000 square feet. Section 438 of the EISA instructs Federal agencies to use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property.

With respect to soil erosion, Section 402(p) of the CWA regulates non-point source discharges of pollutants, under the National Pollutant Discharge Elimination System (NPDES) program, or state equivalent program. This section of the CWA was amended to require the USEPA to establish regulations for discharges from active construction sites. NPDES General Construction Permits require preparation of a Storm Water Pollution Prevention Plan for projects greater than 1 acre.

Prime farmland is protected under the Farmland Protection Policy Act of 1981 (7 CFR 658). Prime farmland is defined as land that has the best combination of physical and chemical

characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses. The land could be cropland, pasture, rangeland, or other land, but not urban built-up land (defined by the U.S. Census Bureau, or U.S. Geological Survey topographic maps) or water. The project area at all four bases is classified by the U.S. Census Bureau as urbanized lands.

B.4.3 METHODOLOGY

Impacts on soils and surface water can result from earth disturbance that would expose soil to wind or water erosion. Analysis of impacts on soils and surface water examines the potential for such erosion at each base and describes typical measures employed to minimize erosion. In addition, soil limitations and associated typical engineering remedial measures are evaluated with respect to proposed construction.

Criteria for evaluating impacts related to soil resources associated with implementation of the KC-46A scenarios are impacts on unique soil resources, minimization of soil erosion, and the siting of facilities relative to potential soil limitations. If development proposed in the EIS were to substantially affect any of these features, impacts would be considered significant.

Soil disturbance at each base was calculated by summing the square footages of additions/alterations and new construction.

Criteria for evaluating impacts related to water resources associated with implementation of the KC-46A scenarios are water availability, water quality, adherence to applicable regulations, and existence of floodplains. Impacts are measured by the potential to reduce water availability to existing users; to endanger public health or safety by creating or worsening health hazards or safety conditions; or to violate laws or regulations adopted to protect or manage water resources.

Flooding impacts are evaluated by determining whether proposed construction is located within a designated floodplain. Groundwater impacts are evaluated by determining whether groundwater beneath the project site would be used for implementing the KC-46A mission, and if so, by determining the potential to adversely affect those groundwater resources. Soils and water resource impacts are not evaluated for the areas below where the KC-46A would be operated or at the auxiliary airfields because no ground-disturbing activities or use of water resources would occur at these locations.

B.5 BIOLOGICAL RESOURCES

B.5.1 RESOURCE DEFINITION

Biological resources include the native and introduced terrestrial and aquatic plants and animals found within the region of influence (ROI). The ROI for biological resources is defined as the land area (habitats) and airspace that could potentially be affected by infrastructure and construction projects, as well as airspace operations. The ROI generally includes the developed cantonment and airfield areas of the respective bases, but may also include areas near but outside the base boundary. Examples of off-base areas include managed wildlife areas and surface waters that could be indirectly affected by noise or water quality alteration, respectively. Habitat types are based on floral, faunal, and geophysical characteristics.

Sensitive habitats include areas that the Federal government, state governments, or the DoD have designated as worthy of special protection due to certain characteristics such as high species diversity, special habitat conditions for rare species, or other unique features.

For purposes of analysis, biological resources were organized into four categories: vegetation, wildlife, special-status species, and wetlands. Vegetation includes existing terrestrial plant communities but does not include special-status plants, which are discussed below. Plant species composition within an area generally defines ecological communities and indicates the type of wildlife that may be present.

Wildlife includes all vertebrate animal species, with the exception of special-status species, which are discussed below. Typical wildlife includes animal groups such as large and small mammals, songbirds, waterfowl, reptiles, amphibians, and fish. The attributes and quality of available habitats influences the composition, diversity, and abundance of wildlife communities.

Special-status species are defined as those plant and animal species protected by various regulations established by Federal and state agencies. These regulations, and the species addressed by them, are described in the Regulatory Setting section below.

Wetlands are areas of transition between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water (Mitsch and Gosselink 2000).

B.5.2 REGULATORY SETTING

"Integrated Natural Resources Management," AFI 32-7064, explains how to manage natural resources on USAF property in compliance with Federal, state, and local standards. The chief tool for managing base ecosystems is the Integrated Natural Resources Management Plan (INRMP). Based on an interdisciplinary approach to ecosystem management, the INRMP ensures the successful accomplishment of the military mission by integrating all aspects of natural resources management with each other and the rest of the base's mission.

Special-status plant and wildlife species are subject to regulations under the authority of Federal and state agencies. Special-status species include species designated as threatened, endangered, or candidate species by state or Federal agencies. Under the Endangered Species Act (ESA) (16 U.S.C. 1536), an endangered species is defined as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as any species likely to become an endangered species in the foreseeable future. Candidate species are those species for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher-priority listing activities. Although candidate species receive no statutory protection under the ESA, the USFWS believes it is important to advise government agencies, industry, and the public that these species are at risk and could warrant protection under the ESA.

The Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-712) is the domestic law that affirms, or implements, the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Each of the conventions protect selected species of birds that are common to both countries (i.e., species occur in both countries at some point during their annual life cycle). The act protects all migratory birds and their parts (including eggs, nests, and feathers).

The Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d) is legislation in the United States that protects two species of eagles. The BGEPA prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald eagles. Taking involves molesting or disturbing birds, their parts, nests, or eggs. The BGEPA provides criminal penalties for persons

who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald or golden eagles... [or any golden eagle], alive or dead, or any part, nest, or egg thereof."

Section 404 of the CWA established a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Activities in waters of the United States that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. The U.S. Army Corps of Engineers (USACE) is the lead agency in protecting wetland resources. This agency maintains jurisdiction over Federal wetlands (33 CFR 328.3) under Section 404 of the CWA (30 CFR 320-330) and Section 10 of the Rivers and Harbors Act (30 CFR 329). The USEPA assists the USACE (in an administrative capacity) in the protection of wetlands (40 CFR 225.1 to 233.71). In addition, the USFWS and the National Marine Fisheries Service provide support with important advisory roles.

Furthermore, Executive Order (EO) 11990, *Protection of Wetlands*, requires Federal agencies, including the USAF, to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. EO 11990 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative; if construction in wetlands cannot be avoided, the USAF will issue a Finding of No Practicable Alternative.

Under CWA Section 401, applicants for a Federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a Federal component and may affect state water quality (including projects that require Federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401.

The following state agencies issue Section 401 certifications in their respective states: the Department of Environmental Quality in Oklahoma; the Department of Ecology in Washington; the Department of Health, Division of Water Quality, in North Dakota; and the Department of Health and Environment in Kansas.

B.5.3 METHODOLOGY

The first step in the analysis of potential impacts on biological resources was to determine the locations of sensitive habitats and species in relation to the proposed action. Maps were examined to locate sensitive habitats and species, and where necessary, site visits and additional surveys were conducted to confirm locations. Next, areas of overlap for the proposed development and sensitive habitats and species were identified. Scientific literature was reviewed for studies that examined similar types of impacts on biological resources. The literature review included a review of basic characteristics and habitat requirements of each sensitive species. Where available, information was also gathered relative to management considerations, incompatible resource management activities, and threats to each sensitive species. Impact analyses were then conducted based on the information gathered from the literature review. The analyses included an assessment of the impacts on biological resources resulting from both construction activities and daily operations. Measures to avoid and/or minimize adverse impacts

on biological resources are also presented. The following criteria were evaluated when determining the significance of an effect on biological resources resulting from implementation of actions described in Volume I, Chapter 2:

- The direct impact or taking of a protected special-status species, including habitat alteration
- The importance (legal, commercial, ecological, or scientific) of the resource
- The relative sensitivity of biological resources to potential effects of the actions
- The quantity or percentage of biological resources affected by the actions relative to overall abundance in the ROI
- The expected duration of potential impacts resulting from implementation of the actions

Determination of the significance of wetland impacts is based on (1) loss of wetland acreage, (2) the function and value of the wetland, (3) the proportion of the wetland that would be affected relative to the occurrence of similar wetlands in the region, (4) the sensitivity of the wetland to proposed activities, and (5) the duration of ecological ramifications. Impacts on wetland resources are considered significant if high-value wetlands would be adversely affected or if wetland acreage is lost.

B.6 CULTURAL RESOURCES

B.6.1 RESOURCE DEFINITION

Cultural resources are historic districts, sites, buildings, structures, or objects considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic architectural/engineering resources, and traditional resources. Only significant cultural resources are considered for potential adverse impacts from an action. Significant cultural resources are those eligible for inclusion in the National Register of Historic Places (NRHP), as set forth in 36 CFR 60.4, or identified as important to tribes or other traditional groups, as outlined in the American Indian Religious Freedom Act; the Native American Graves Protection and Repatriation Act; and EO 13007, *Indian Sacred Sites*. Historic properties are any prehistoric or historic districts, sites, buildings, structures, or objects included or eligible for inclusion in the NRHP because of their historic or cultural significance. For a cultural resource to be considered eligible for the NRHP, it must possess integrity of location, design, setting, materials, workmanship, feeling, or association, and it must meet one or more of the following criteria (36 CFR 60.4):

- Association with events that have made a significant contribution to the broad patterns of our history (criterion a).
- Association with the lives or persons significant in our past (criterion b).
- Embodiment of distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction (criterion c).
- Have yielded, or may be likely to yield, information important in prehistory or history (criterion d).

In general, these resources must be more than 50 years old; however, younger resources may be eligible if they are exceptionally significant.

Section 101(d)(6)(A) of the National Historic Preservation Act (NHPA) states that properties of traditional religious and cultural importance to a tribe or Native Hawaiian organization may be determined to be eligible for inclusion in the NRHP. NRHP Bulletin 38 (NPS 1998) defines traditional cultural property (TCP), generally, as one that is eligible for inclusion in the NRHP. Reasons for eligibility could be because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. TCPs can include archaeological resources, buildings, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that tribes and other groups consider essential for the continuance of traditional cultures.

However, properties of traditional religious and cultural importance need not be determined eligible for the NRHP to be a significant cultural resource considered for potential adverse impacts from an action. On 21 November 1999, the DoD promulgated its American Indian and Alaska Native Policy, which emphasizes the importance of respecting and consulting with tribal governments on a government-to-government basis (DoD 1999). The policy requires an assessment, through consultation, of the effect of proposed DoD actions that may have the potential to significantly affect protected tribal resources, tribal rights, and tribal and Alaska Native lands, before decisions are made by the services. DoDI 4710.02, "DoD Interactions with Federally-Recognized Tribes," implements DoD policy, assigns responsibilities, and provides procedures for DoD interactions with federally recognized tribes in accordance with its American Indian and Alaska Native Policy and other DoD directives and policies.

EO 13007 defines *sacred sites* as any specific, discrete, narrowly delineated location on Federal land that is identified by a tribe or individual as sacred by virtue of its established religious significance to or ceremonial use by a tribal religion and identified as such to the land managing agency. EO 13007 also requires agencies to accommodate access to, and ceremonial use of, sacred sites by tribal religious practitioners and to avoid adversely affecting their physical integrity.

B.6.2 REGULATORY SETTING

"Cultural Resources Management," DoDI 4715.16, (DoD 2008), and AFI 32-7065, "Cultural Resources Management," (USAF 2004) outline and specify proper procedures for cultural resource management on USAF bases.

Laws pertinent to the proposed action include the NHPA of 1966, as amended; the Antiquities Act of 1906; the Historic Sites Act of 1935; NEPA; the Archaeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the Native American Graves Protection and Repatriation Act of 1990; and the American Indian Religious Freedom Act of 1978.

Under Section 106 of the NHPA, the USAF is required to consider the effects of its undertakings at each location on historic properties listed, or eligible for listing, in the NRHP and to consult with the State Historic Preservation Office (SHPO), Tribal Historic Preservation Office, and others regarding potential effects as per 36 CFR 800. Under AFI 32-7065, recorded cultural resources not evaluated for NRHP eligibility must be managed as eligible. Under Section 110 of the NHPA, each location is mandated to maintain an active historic preservation program and provide stewardship of cultural resources "consistent with the preservation of such properties and the mission of the agency (Section 470 h-2(a))."

Federal regulations governing cultural resource activities include the following: 36 CFR 800, *Protection of Historic Properties* (incorporating amendments effective August 5, 2004); 36 CFR 79, *Curation of Federally Owned and Administered Archaeological Collections*; 43 CFR 7, *Protection of Archaeological Resources*; 36 CFR 60, *National Register of Historic Places*; and 36 CFR 63, *Determinations of Eligibility for Inclusion in the National Register*. Cultural resource-related EOs that may affect the locations include the following: EO 11593, *Protection and Enhancement of the Cultural Environment*; EO 13007, *Indian Sacred Sites*; EO 13175, *Consultation and Coordination with Indian Tribal Governments*; and EO 13287, *Preserve America*.

B.6.3 METHODOLOGY

Impact analysis for cultural resources focuses on assessing whether the KC-46A mission would have the potential to affect cultural resources that are eligible for listing in the NRHP or have traditional significance for tribes. For this Final EIS, impact analysis for cultural resources focuses on, but is not limited to, guidelines and standards set forth in NHPA Section 106's implementing regulations (36 CFR 800). Under Section 106 of the NHPA, the proponent of the action is responsible for determining whether any historic properties are located in the area, assessing whether the proposed undertaking would adversely affect the resources, and notifying the SHPO of any adverse effects. An adverse effect is any action that may directly or indirectly change the characteristics that make the historic property eligible for listing in the NRHP. If an adverse effect is identified, the Federal agency consults with the SHPO and federally recognized tribes to develop measures to avoid, minimize, or mitigate the adverse effects of the undertaking.

Analysis of potential impacts on cultural resources considers both direct and indirect impacts.

Impacts may occur through the following:

- Physically altering, damaging, or destroying all or part of a resource
- Altering characteristics of the surrounding environment that contribute to the resource's significance
- Introducing visual or audible elements that are out of character with the property or alter its setting
- Neglecting the resource to the extent that it deteriorates or is destroyed

Direct impacts are assessed by (1) identifying the nature and location of all elements of the proposed action and alternatives; (2) comparing those locations with identified historic properties, sensitive areas, and surveyed locations; (3) determining the known or potential significance of historic properties that could be affected; and (4) assessing the extent and intensity of the effects. Indirect impacts occur later in time or farther from the proposed action. Indirect impacts on cultural resources generally result from the effects of project-induced population increases, such as the need to develop new housing areas, utility services, and other support functions to accommodate population growth, or increased visitation of a remote area due to improved vehicle access. These activities and the subsequent use of the facilities can impact cultural resources.

A key component of this analysis is defining the area of potential effect, defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 CFR 800.16(d)).

Archaeological and historic architectural resources at the bases were characterized using existing survey and analysis information from Integrated Cultural Resources Management Plans (ICRMPs), archaeological survey reports, historic buildings survey reports, local histories, and the records of the NRHP and National Historic Landmarks. These documents provided information on known locations of significant resources. In compliance with Section 106 of the NHPA, the USAF consulted with the relevant SHPOs regarding the area of potential effect and potential cultural resource concerns for the proposed action. NRHP-eligible or -listed properties at each base are identified in the base-specific sections.

The potential for traditional resources at the bases was identified using ICRMPS and information provided by base cultural resource management staff. Potentially interested tribes were contacted to request information on potential concerns about the proposed action.

In this analysis, demolition, construction, and other base-specific actions needed to support the KC-46A basing are part of the alternatives. The assessment of adverse effects takes into account both the potential for physical damage or destruction of historic properties at the bases and the potential adverse effects of visual intrusions, noise, and vibration on historic properties at the bases. Properties eligible for inclusion in the NRHP for their scientific information potential generally are not adversely affected by the introduction of auditory or visual intrusions. Conversely, if integrity of setting or feeling is an important element of a property's eligibility, that property may be adversely affected by the introduction of auditory or visual intrusions.

Impacts on properties of traditional religious and cultural importance (hereafter referred to as "traditional cultural resources") can result from noise and visual effects of aircraft overflights on rituals and ceremonies and on wildlife resources. The USAF's ongoing consultation with tribes may identify places of traditional cultural importance or other types of cultural resources that might be adversely affected by auditory or visual intrusions or other elements of the proposed action.

B.7 LAND USE

B.7.1 RESOURCE DEFINITION

Land use describes the way the natural landscape has been modified or managed to provide for human needs. In developed and urbanized areas, land uses typically include residential, commercial, industrial, utilities and transportation, recreation, open space, and mixes of these basic types. Other uses such as mining, extractive activities, agriculture, forestry, and specially protected areas (such as larger monuments, parks, and preserves) are usually found on the fringes or outside of urbanized areas. Plans and policies guide how land resources are allocated and managed to best serve multiple needs and interests. Ordinances and regulations define specific limitations on uses.

The attributes of land use addressed in this analysis include general land use patterns within and surrounding each military base and the land use regulatory setting. The regulatory setting is the framework for managing land use and approving new development. It pertains to Federal, state, and local statutes, regulations, plans, programs, and ordinances.

Region of Influence. The ROI for the land use analyses in this Final EIS includes the land within and surrounding each base. The analysis considers an area that encompasses the full extent of airfield accident zones, and areas exposed to noise levels of concern, plus a reasonable buffer of a few miles. This ROI provides for a wider context of jurisdictional divisions that influence land use patterns around each base.

B.7.2 REGULATORY SETTING

The regulatory setting for land use includes the key Federal, state, and local statutes, regulations, plans, policies, and programs applicable to land use on and near each base. The land use discipline assumed the Federal noise compatibility requirements as identified below.

Airfield and Heliport Planning and Design – DoD UFC 3-260-01. Several siting criteria have been established specific to land development and use at commercial and military airfields. To maintain safety, the USAF adheres to guidelines set forth in UFC 3-260-01, *Airfield and Heliport Planning and Design* (UFC 3-260-01). These criteria include CZs, APZs, and other obstruction zones relative to airfield environments. These and other criteria related to safety, security, and other land use issues are used to assist planners and decision makers with appropriate siting of facilities affecting design and physical layout of USAF bases.

FICUN Land Use Guidelines (1980). In 1980, FICUN was formed to develop Federal policy and guidance on noise. The committee included the USEPA, FAA, Federal Highway Administration, DoD, Department of Housing and Urban Development, and the U.S. Department of Veterans Affairs. The designations contained in the FICUN compatibility table for land use do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities.

Air Installation Compatibility Use Zone (AICUZ) Program (DoDI 4165.57). Establishes the AICUZ program, which is similar to the FAA's Federal Aviation Regulations Part 150 program for civil airports. The AICUZ program is a DoD discretionary program designed to promote compatible land use around military airfields. The military services maintain an AICUZ program to protect the operational integrity of their flying mission.

Areas around airfields are exposed to the potential of aircraft accidents despite well-maintained aircraft with highly trained aircrews. DoD developed the AICUZ program to aid in the development of planning mechanisms that protect the safety and health of personnel on and near military airfields and to preserve operational capabilities. The AICUZ program consists of three distinct parts: APZs, hazards to air navigation (height and obstruction criteria established by the FAA), and noise zones.

Bases use the AICUZ program to provide land use compatibility guidelines for areas exposed to increased safety risks and noise near the airfield. The noise compatibility guidelines recommended in the AICUZ program are similar to those used by the Department of Housing and Urban Development and FAA to provide information to surrounding jurisdictions to guide planning and regulation of land use. When noise levels exceed a DNL of 65 dB, residential land uses are normally considered incompatible.

B.7.3 METHODOLOGY

Potential impacts on land use can result from actions that (1) change the suitability of a location for its current or planned use (e.g., noise exposure in residential areas); (2) cause conditions that are unsafe for the public welfare; (3) conflict with the current and planned use of the area based on current zoning, amendments, agreements, regulatory restrictions, management, and land use plans; or (4) displace a current use with a use that does not meet the goals, objectives, and desired use for an area based on public plans or resolutions. The degree of land use effects (negligible, minor, moderate, or significant) is based on the level of land use sensitivity in areas

affected by a proposed action, the magnitude of change, and the compatibility of a proposed action with existing or planned land uses. The assessment considers multiple contextual factors that are both quantified and qualitative.

The evaluation primarily focuses on changes resulting from the action that may affect off-base areas. Also considered are potential effects on community amenities within the base such as schools, child care facilities, and housing areas. For each scenario, the following land use impact drivers are considered:

- Construction and demolition on base (effects such as temporary dust, noise and traffic and longer-term noise or visual changes affecting community areas and nearby off-base locations). The assessment considers the extent of redevelopment, duration, and proximity to sensitive locations of on-base and off-base areas.
- O&M activities for the new mission (generating noise, odors, or traffic). The assessment considers whether the action involves any unusual or new activities, and proximity to sensitive locations of on-base and off-base areas.
- Aircraft operations at the base and in the surrounding area, including engine run ups, takeoffs and landings, and closed pattern work. The assessment evaluates changes in noise exposure levels and the location of noise relative to existing land use, planned uses, and zoning, focusing on land use compatibility with projected noise levels and accident potential following DoD guidelines.
- Change in base population (causing indirect impacts such as congestion in nearby neighborhoods).

The following steps are used to evaluate the impacts on land use from the proposed alternatives:

1. Characterize and describe existing land use and conditions (Volume I, Chapter 3).
    - Describe general context for the base in the local area (whether urbanized, rural, or natural) and describe jurisdictional boundaries within the area around the airfield.
    - Describe the overall organization of functions on the base (using site plans, Base General Plans, other NEPA documents).
    - Describe the land use setting surrounding the base, using aerial photography (National Agriculture Imagery Program [NAIP] 1-meter aerial imagery), notes from site visits, land use plans by local jurisdictions, current zoning.
    - Describe current compatibility planning efforts for the base and status of compatibility around the airfield (based on AICUZ studies, Joint Land Use Studies, airfield zoning districts, airfield noise complaint logs).
    - Identify current noise exposure for land uses surrounding the airfield (using maps with baseline noise contours superimposed on aerial photography), describe noise levels affecting current uses and compatibility of the current exposure levels, and identify specific sensitive receptors affected by incompatible noise levels (such as schools and child development centers) based on the DoD noise compatibility guidelines.
2. Evaluate effects on land use of new construction and demolition. The analysis considers direct and indirect effects of redevelopment based on size of construction effort, location of projects relative to sensitive uses (for example, new industrial-type functions relative to family housing areas), and duration of construction.

3. Evaluate effects on land use of new O&M activities. Qualitatively consider if changes in O&M activities can have indirect effects on the suitability of areas outside the base for their current or planned uses. These effects may include dust, noise, traffic, visual modifications.
4. Assess whether any induced changes such as new housing demands in the local area pose any particular concerns for land use.
5. Quantify and locate changes in noise exposure from aircraft operations.
    - Estimate change in acreage of land on and off the base exposed to noise levels of 65 dB DNL and greater at 5 dB intervals. Consider the relative degree of change in exposure in the surrounding area.
    - Overlay projected and baseline noise contours on aerial photographs to locate where changes in noise exposure would occur. Identify projected noise exposure for land uses surrounding the airfield (using maps with baseline noise contours superimposed on aerial photography). Describe where the changes occur, what land use is affected, degree of change (decibel increase), and compatibility of the land use with the change.
    - Where changes in exposure interact with incompatible land use, a more careful evaluation of the zoning and potential future development of the affected area is included. This considers potential for future changes in land use or infill that could heighten an existing incompatible condition. Where residential land is impacted, review of aerial photography and zoning ordinances is used to determine the relative density of homes and potential for future infill. The analysis also identifies how and if current noise compatibility planning is adequate to protect airfield and community interests.
6. The impact assessment considers the degree or intensity of projected accident risk at the airfield in combination with current or possible future incompatible uses in the APZs (context). The analysis rates the degree of existing land use compatibility in the CZs and APZs based on DoD's land use compatibility guidelines using levels of incompatible land uses and occupied structures within the APZs and CZs. Because accident risk is extremely low, the current condition of land use compatibility in the APZs and CZs is the dominant criteria in assessing impacts on land use.

B.8 INFRASTRUCTURE

B.8.1 RESOURCE DEFINITION

Infrastructure consists of the systems and physical structures that enable the population of a USAF base to function. Infrastructure is primarily human-made, with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as urban, or developed built environment. The availability of infrastructure and its capacity for expansion are essential to the ability of the base to carry out a specific mission, operations, and provide for the needs of the employees and residents.

Utilities analyzed for each of the four bases in this Final EIS include water supply and distribution, sanitary sewer and wastewater systems, stormwater drainage, electrical system, natural gas, solid waste, and transportation. Solid waste management primarily relates to the availability of systems and landfills to support a population's residential, commercial, and

industrial needs. AFI 32-7042, "Waste Management," incorporates the requirements of Subtitle D, 40 CFR 240 through 244, 257, and 258, applicable Federal regulations, AFIs, and DoD directives. It also establishes the requirement for bases to have a solid waste management plan; procedures for handling, storage, collection, and disposal of solid waste; record keeping and reporting; and pollution prevention (USAF 2009). The infrastructure information contained in this section provides a brief overview of each infrastructure component and describes its capacities, effectiveness, deficiencies, and existing general condition.

Transportation infrastructure includes the public roadway network, public transportation systems, airports, railroads, pedestrian/bicycle facilities, and waterborne transportation required for the movement of people, materials, and goods. The proposed action has the potential to impact the public roadways that provide access to the bases, base access control points or gates, and the internal roadway systems of the bases. Roadways are typically assigned a functional classification by state departments of transportation. Functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. The three main functional classifications for roadways include:

- Arterial – These roadways provided mobility so traffic can move from one place to another quickly and safely.
- Collector – These roadways link arterials and local roads and perform some of the duties of each.
- Local – These roadways provide access to homes, businesses, and other property.

B.8.2 REGULATORY SETTING

There is no applicable regulatory setting for infrastructure and transportation resources.

B.8.3 METHODOLOGY

Effects on infrastructure were evaluated for the KC-46A FTU and MOB 1 scenarios based on the potential for disruption or improvement of existing levels of service and additional needs for water, energy and natural gas consumption, wastewater and stormwater drainage systems, and solid waste system availability. Changes in population and proposed development were used to determine impact on infrastructure. For each scenario, the maximum demand or impact to capacity was calculated for the potable water, wastewater, electric and natural gas systems based on the change in population. For the transportation analysis, any change in population was assumed to reside off base.

The impact analysis consisted of a quantitative assessment, based on available information for average and peak use and demand data for each on-base utility and the ability of a utility provider to absorb a given level of demand increase for its service area, and a qualitative assessment of the physical condition of each on-base system. Impacts might arise from physical changes to utility supply and distribution systems over their design life cycle and energy needs created by either direct or indirect workforce and population changes related to base activities. An effect would be considered adverse if the proposed FTU or MOB 1 scenario requirements caused any of the following:

- A violation of a permit condition or contract with a utility provider
- A capacity exceedance of a utility or solid waste facility

- If a system could not sustain a mission increase due to poor condition, inefficient function, or operation
- If a mission increase would require costly upgrades
- A long-term interruption of a utility

To assess the potential environmental consequences associated with transportation resources, increased utilization of the existing roadway system and base access gates due to the potential increase of personnel is analyzed, as well as potential effects of construction activities. Impacts could arise from physical changes to circulation, construction-related traffic delays, and changes in traffic volumes. Adverse impacts on roadway capacities would be significant if roads with no history of capacity exceedance had to operate at or above their full design capacity as a result of implementation of the KC-46A scenarios.

B.9 HAZARDOUS MATERIALS AND WASTE

B.9.1 RESOURCE DEFINITION

The terms “hazardous materials” and “hazardous waste” refer to substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristic, may present substantial danger to public health or the environment when released into the environment.

Products containing hazardous materials that may result in the generation of hazardous waste include aviation fuel, adhesives, sealants, conversion coatings, corrosion preventative compounds, hydraulic fluids, lubricants, oils, paints, polishes, thinners, and cleaners.

B.9.2 REGULATORY SETTING

The key Federal regulatory requirements related to hazardous materials and waste include:

- Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.)
- Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 11001-11050)
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601-9675)
- Community Environmental Response Facilitation Act of 1992 (42 U.S.C. 9620)
- Asbestos Hazard Emergency Response Act (15 U.S.C. 2651)
- Spill Prevention, Control and Countermeasure Rule (40 CFR 112)
- USEPA Regulation on Identification and Listing of Hazardous Waste (40 CFR 261)
- USEPA Regulation on Standards for the Management of Used Oil (40 CFR 279)
- USEPA Regulation on Designation, Reportable Quantities, and Notification (40 CFR 302)
- EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*
- Toxic Substances Control Act of 1976 (40 CFR 700–766)
- Clean Air Act of 1970, including the 1990 Clean Air Act Amendments (40 CFR 61)

Several USAF regulations address the management and safe handling of hazardous materials and wastes in accordance with applicable Federal and state regulations. These include:

- AFI 32-7086, "Hazardous Material Management"
- AFI 32-7042, "Solid and Hazardous Waste Compliance"
- AFI 32-1052, "Facility Asbestos Management"

B.9.3 METHODOLOGY

The exact amounts of hazardous waste that would be generated under each scenario are unknown at this time. The qualitative and quantitative assessment of impacts from hazardous materials and waste management focuses on how (context) and to what degree (intensity) each location could affect hazardous materials usage and management, hazardous waste generation and management, and hazardous waste disposal. Potential impacts related to hazardous materials and wastes were analyzed for the following five effects:

1. Generation of hazardous material/waste types or quantities could not be accommodated by the current management system.
2. Increased likelihood of an uncontrolled release of hazardous materials that could contaminate the soil, surface water, groundwater, or air.
3. Non-compliance with applicable Federal and state regulations as a result of the proposed action.
4. Disturbance or creation of contaminated sites, resulting in adverse effects on human health and/or the environment.
5. Established management policies, procedures, and handling capacities could not accommodate the proposed action.

B.10 SOCIOECONOMICS

B.10.1 RESOURCE DEFINITION

Socioeconomics refers to features or characteristics of the social and economic environment. The main concern for socioeconomic resources is the change in personnel associated with the KC-46A FTU and MOB 1 scenarios that could potentially impact population, employment, earnings, housing, education, and public services.

B.10.2 REGULATORY SETTING

There is no applicable regulatory setting for socioeconomics.

B.10.3 METHODOLOGY

The socioeconomic analysis focuses on the effects resulting from the personnel changes, as well as construction and/or operation and maintenance under each scenario. To estimate the changes in population to the ROI, the total number of military personnel, military dependents and family members, and students (if any) as indicated in the personnel tables in Volume I, Chapter 2 (Tables 2-4, 2-7, 2-10, 2-13, 2-16, 2-19) were added together and assumed to be migrating to the area. For this analysis, any DoD civilians, part-time Reservists, or contractors (other base personnel) identified in Volume I, Chapter 2, associated with the KC-46A FTU scenario, MOB 1 scenario, or KC-135 mission were assumed to be from the local population and were not considered to be incoming personnel. Therefore, under these assumptions, the changes to the

number of DoD civilians, part-time Reservists, and contractors would not impact population, housing, education, or public services.

To determine the change in on-base jobs, the total change in full-time military personnel, students (if any), DoD civilians, and contractors was added to the existing on-base total work force. Part-time Reservists were not considered to be part of the work force since the Air Force Reserves typically only serve one weekend per month, in any areas they choose to live, and are on temporary duty assignment two weeks a year. For this reason, any change in the number of part-time Reservists associated with each scenario was also not considered as part of the incoming population that would impact housing, economic activity, education, public services, and base services.

The economic impact analysis used to determine the effect of construction and operation and maintenance costs (if any) was conducted using the Impact Analysis for Planning (IMPLAN) economic forecasting model. The IMPLAN model uses data from the U.S. Bureau of Labor Statistics and the U.S. Bureau of Economic Analysis to construct a mathematical representation of the local economics using the region-specific spending patterns, economic multipliers, and industries (MIG 2012). In this analysis, the IMPLAN model provided representations of the county-wide economy at each location. Economic impacts are analyzed by introducing a change to a specific industry in the form of increased or decreased employment or spending; the IMPLAN model mathematically calculates the resulting changes in the local economy. In this analysis, the IMPLAN model estimates the economic effects of the incoming personnel on spending and employment in the established ROI. The economic impacts analysis separates effects into three components: direct, indirect, and induced. Direct effects are the change in employment and income generated directly by the expenditures of the incoming or outgoing personnel. To produce the goods and services demanded by the incoming personnel, businesses, in turn, may need to purchase additional goods and services from other businesses. The employment and incomes generated by these secondary purchases would result in the indirect effects. Induced effects are the increased household spending generated by the direct and indirect effects. The overall effect from the economic impact analysis is the total number of jobs created throughout the ROI by the direct, indirect, and induced effects. The construction and O&M costs used in the economic activity section were provided by the USAF during the site survey reports.

To determine whether the local housing market could support the personnel associated with the FTU or MOB 1 scenarios, several assumptions were made. The first assumption was that DoD civilians, part-time Reservists, and contractors were already residing in the local population and any change to the number of these personnel would not influence the local housing market. The second assumption was that the total number of homes required off base was equal to the total number of incoming full-time military personnel. This number was compared against the number of vacant housing units as defined by the 2010 census. If the number of incoming full-time military personnel did not exceed the number of vacant housing units as defined by the 2010 census, the housing market in the ROI was anticipated to be able to support the incoming population.

Students assigned to the FTU would be assumed to be in transient status. Of the 200 students associated with the FTU scenario, 180 students would be lodged in either on base or off base facilities. The other 20 students would be assumed to be non-prior service Airmen, and would thus be required to live in an on base dormitory. Therefore, under each of the FTU scenarios, there would be a potential need for 180 lodging units on or off base and 20 dormitory units on base to support the average daily student load of 200.

To determine the total dependents for each base associated with the KC-46A mission and KC-135 drawdown mission (where appropriate), 65 percent of all full-time military personnel, as identified in the personnel tables in Volume I, Chapter 2 (See Tables 2-4, 2-7, 2-10, 2-13, 2-16, 2-19), were assumed to be accompanied. Each accompanied military member was assumed to be accompanied by 2.5 dependents, or 1 spouse and approximately 1.5 children. All children were assumed to be of school age. Therefore, to determine the total number of school-aged children, a multiplier of 1.5 was applied to 65 percent of the full-time military personnel.

Public services were analyzed by considering the overall percentage change to the county population. Base services were analyzed by considering the capacity, staffing, and infrastructure available to support the incoming personnel.

The magnitude of potential impacts can vary greatly, depending on the location of the proposed action. If potential socioeconomic changes were to result in substantial shifts in population trends or a decrease in regional spending or earning patterns, those effects would be considered adverse. A proposed action could have a significant effect with respect to socioeconomic conditions in the surrounding ROI if the following were to occur:

- Change in the local business volume, employment, or population that exceeds the ROI's historical annual change
- Adverse change on social services or social conditions, including property values, school enrollment, county or municipal expenditures, or crime rates

B.11 ENVIRONMENTAL JUSTICE AND PROTECTION OF CHILDREN

B.11.1 RESOURCE DEFINITION

The resource considered for environmental justice is potentially affected populations that meet certain characteristics based on race, income, and age. The resource is defined relatively, in order to understand if impacts from an action are occurring in areas that are disproportionately composed of minorities, low-income persons, and children. This concern arises because large impact projects have historically used sites where real estate values are lower and/or more industrialized. Locations with low property values have tended to attract development of affordable and marginal housing. This dynamic tends to perpetuate and often pre-dates the enactment of community land use ordinances. The intent of environmental justice is to reduce the burden of impacts on socially and economically vulnerable populations.

B.11.2 REGULATORY SETTING

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, EO 12898, directs Federal agencies to address environmental and human health conditions in minority and low-income communities. In addition to environmental justice issues are concerns pursuant to EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which directs Federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children.

USAF guidance for implementation of the EO is contained in the *Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process*, dated November 1997 (CEQ 1997). Minority populations include all persons identified by the 2010 census to be of Hispanic origin, regardless of race, and all persons not of Hispanic origin other than White (i.e., non-Hispanic persons who are Black, American Indian, Eskimo or Aleut, Asian or Pacific Islander, or other race).

The 2010 census did not collect information on income or poverty levels. The latest information on poverty was released in 2012 as a 5-year average from 2007 to 2011 as part of the American Community Survey. Low-income populations include persons living below the poverty level. The poverty level or threshold varies by size of family and number of children under 18 years (i.e., $23,021 for a family of four in 2011). If the total family income is less than the threshold, then the family and every individual in it (or unrelated individuals) is in poverty. The percentage of low-income persons is calculated as a percentage of all persons for whom the U.S. Census Bureau determines poverty status, which is generally a slightly lower number than the total population, as it excludes institutionalized persons, persons in military group quarters and in college dormitories, and unrelated individuals under 15 years old.

B.11.3 METHODOLOGY

Analysis of environmental justice focuses on potentially unavoidable significant adverse impacts on any of the resource areas evaluated in this Final EIS. If no potentially significant impacts are identified, an evaluation of environmental justice is not triggered. Where potentially significant impacts are identified in the EIS, the percentages of low-income persons, minority persons, and children under 18 are calculated for the population of the affected area. These percentages are compared to those of the region of comparison to determine if the affected population is disproportionately composed of low-income persons, minority persons, and children under age 18 (i.e., higher than the region of comparison).

Since the proposed construction activities would occur within the base boundaries, the only action with the potential to cause adverse impacts is related to the new noise levels generated in the vicinity of each of the bases under consideration for the FTU or MOB 1 actions. Therefore, the ROI for the environmental justice analysis in this Final EIS uses the county as the region of comparison, and focuses on the demographics of specific affected populations for each of the bases evaluated. Should the analysis of impacts in the EIS conclude that a potentially unavoidable significant impact could occur, the composition of the affected population (i.e., percentages of low-income, minority, and children under age 18) is compared to the region (i.e., the county) to assess if the impact is borne disproportionately by minorities, low-income persons, or children.

For the purposes of this analysis, children are defined as persons age 17 and younger, as enumerated by the 2010 census. For the purposes of this analysis, the proportion of affected low-income population in the 2000 census is evaluated to the census tract level. That percentage is then applied to the affected 2010 population as an estimate of the number of low-income persons affected under the 2010 census. The proportion of affected minority and children under 18 in the 2000 census is evaluated to the census block level, and then applied to the affected 2010 population.

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AFI 32-7064 – Integrated Natural Resources Management

AFI 32-7065 – Cultural Resources Management

AFI 32-7086 – Hazardous Material Management

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33 CFR 328.3 – Definition of Waters of the United States

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EO 13045, Protection of Children from Environmental Health Risks and Safety Risks

EO 13175, Consultation and Coordination with Indian Tribal Governments

EO 13287, Preserve America

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APPENDIX C

BACKGROUND INFORMATION FOR THE NOISE ANALYSIS

APPENDIX C BACKGROUND INFORMATION FOR THE NOISE ANALYSIS

This appendix provides a general noise primer to educate the reader on what constitutes noise, how it is measured, and the studies that were used in support of how and why noise is modeled.

Noise is generally described as unwanted sound. Unwanted sound can be based on objective effects (such as hearing loss or damage to structures) or subjective judgments (community annoyance). Noise analysis thus requires a combination of physical measurement of sound, physical and physiological effects, plus psycho- and socio-acoustic effects.

This appendix describes how sound is measured and summarizes noise impacts in terms of community acceptability and land use compatibility; gives detailed descriptions of the effects of noise that lead to the impact guidelines presented; and provides a description of the specific methods used to predict aircraft noise, including a detailed description of sonic booms.

C.1 NOISE DESCRIPTORS AND IMPACT

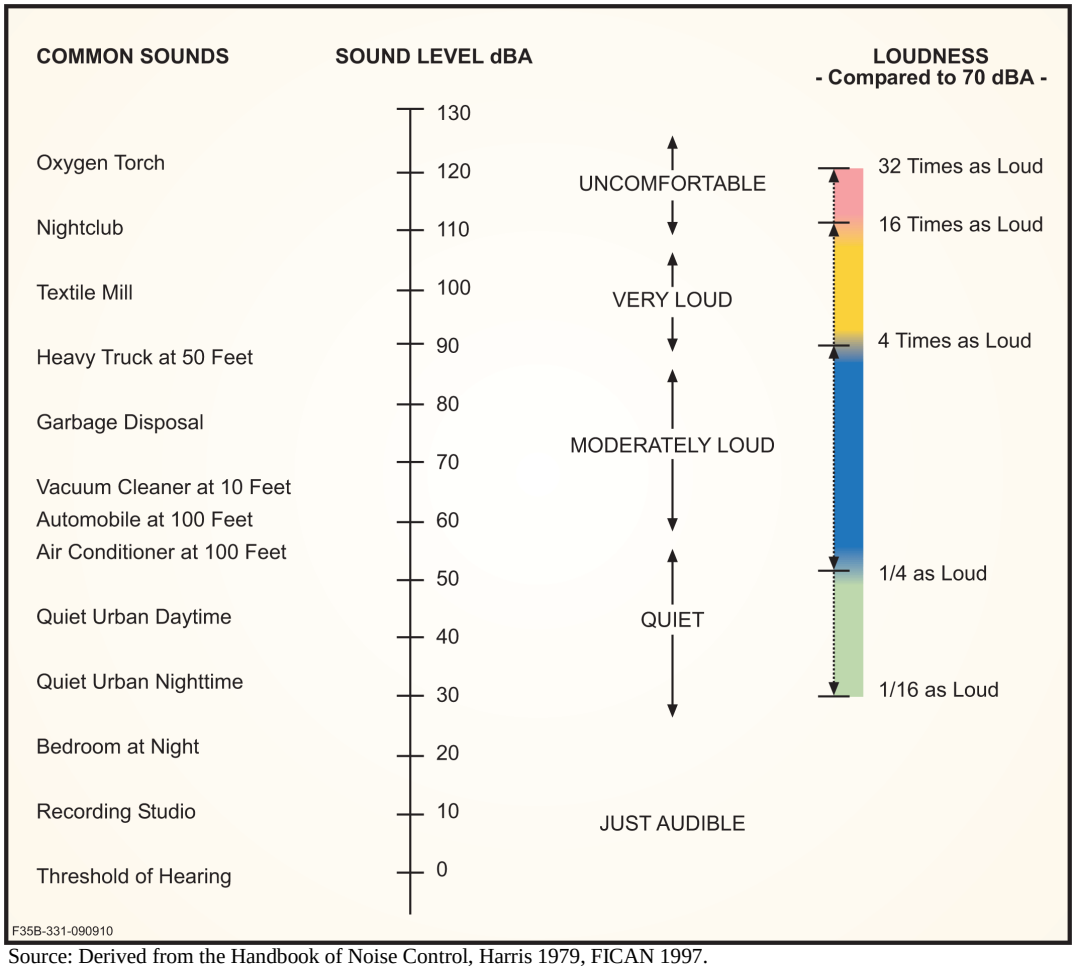
The following subsections describe the characteristics used to describe sound, the specific noise metrics used for noise impact analysis, and how environmental impact and land use compatibility are judged in terms of these quantities.

C.1.1 QUANTIFYING SOUND

Measurement and perception of sound involve two basic physical characteristics: amplitude and frequency. Amplitude is a measure of the strength of the sound and is directly measured in terms of the pressure of a sound wave. Because sound pressure varies in time, various types of pressure averages are usually used. Frequency, commonly perceived as pitch, is the number of times per second the sound causes air molecules to oscillate. Frequency is measured in units of cycles per second, or hertz (Hz).

Amplitude. The loudest sounds the human ear can comfortably hear have acoustic energy one trillion times the acoustic energy of sounds the ear can barely detect. Because of this vast range, attempts to represent sound amplitude by pressure are generally unwieldy. Sound is, therefore, usually represented on a logarithmic scale with a unit called the decibel (dB). Sound measured on the decibel scale is referred to as a sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

Figure C-1 is a chart of A-weighted sound levels from typical sounds. Some (air conditioner, vacuum cleaner) are continuous sounds whose levels are constant for some time. Some (automobile, heavy truck) are the maximum sound during a vehicle passby. Some (urban daytime, urban nighttime) are averages over some extended period.



Source: Derived from the Handbook of Noise Control, Harris 1979, FICAN 1997.

Figure C-1. Typical A-Weighted Sound Levels of Common Sounds

Because of the logarithmic nature of the decibel scale, sounds levels do not add and subtract directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels behaves differently than that of ordinary numbers, such addition is often referred to as "decibel addition" or "energy addition." The latter term arises from the fact that the combination of decibel values consists of first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

The difference in decibels between two sounds represents the ratio of the amplitudes of those two sounds. Because human senses tend to be proportional (i.e., detect whether one sound is

twice as big as another) rather than absolute (i.e., detect whether one sound is a given number of pressure units bigger than another), the decibel scale correlates well with human response.

Under laboratory conditions, differences in sound level of 1 dB can be detected by the human ear. In the community, the smallest change in average noise level that can be detected is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relation holds true for loud sounds and for quieter sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound *intensity* but only a 50 percent decrease in perceived *loudness* because of the nonlinear response of the human ear (similar to most human senses).

The one exception to the exclusive use of levels, rather than physical pressure units, to quantify sound is in the case of sonic booms. Sonic booms are coherent waves with specific characteristics. There is a long-standing tradition of describing individual sonic booms by the amplitude of the shock waves, in pounds per square foot. This is particularly relevant when assessing structural effects as opposed to loudness or cumulative community response. In this environmental analysis, sonic booms are quantified by either decibels or pounds per square foot, as appropriate for the particular impact being assessed.

Frequency. The normal human ear can hear frequencies from about 20 Hz to about 20,000 Hz. It is most sensitive to sounds in the 1,000 to 4,000 Hz range. When measuring community response to noise, it is common to adjust the frequency content of the measured sound to correspond to the frequency sensitivity of the human ear. This adjustment is called A-weighting (ANSI 1988). Sound levels that have been so adjusted are referred to as A-weighted sound levels.

The audible quality of high-thrust engines in modern military combat aircraft can be somewhat different than other aircraft, including (at high throttle settings) the characteristic nonlinear crackle of high-thrust engines. The spectral characteristics of various noises are accounted for by A-weighting, which approximates the response of the human ear but does not necessarily account for quality. There are other, more detailed, weighting factors that have been applied to sounds. In the 1950s and 1960s, when noise from civilian jet aircraft became an issue, substantial research was performed to determine what characteristics of jet noise were a problem. The metrics Perceived Noise Level and Effective Perceived Noise Level were developed. These accounted for nonlinear behavior of hearing and the importance of low frequencies at high levels, and for many years airport/airbase noise contours were presented in terms of Noise Exposure Forecast, which was based on Perceived Noise Level and Effective Perceived Noise Level. In the 1970s, however, it was realized that the primary intrusive aspect of aircraft noise was the high noise level, a factor that is well represented by A-weighted levels and day-night average sound level (DNL). The refinement of Perceived Noise Level, Effective Perceived Noise Level, and Noise Exposure Forecast was not significant in protecting the public from noise.

There has been continuing research on noise metrics and the importance of sound quality, sponsored by the U.S. Department of Defense (DoD) for military aircraft noise and by the Federal Aviation Administration (FAA) for civil aircraft noise. The metric L_{dnmr}, which is described later and accounts for the increased annoyance of rapid onset rate of sound, is a product of this long-term research.

The amplitude of A-weighted sound levels is measured in decibels. It is common for some noise analysts to denote the unit of A-weighted sounds by dBA. As long as the use of A-weighting is understood, there is no difference between dB or dBA: it is only important that the use of A-weighting be made clear. In this environmental analysis, A-weighted sound levels are reported as dB.

Time Averaging. Sound pressure of a continuous sound varies greatly with time, so it is customary to deal with sound levels that represent averages over time. Levels presented as instantaneous (i.e., as might be read from the display of a sound level meter) are based on averages of sound energy over either 1/8 second (fast) or 1 second (slow). The formal definitions of fast and slow levels are somewhat complex, with details that are important to the makers and users of instrumentation. They may, however, be thought of as levels corresponding to the root mean square sound pressure measured over the 1/8-second or 1-second periods.

C.1.2 NOISE METRICS

C.1.2.1 Sound Exposure Level

Individual time-varying noise events have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. Although the maximum sound level reached during the event provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (abbreviated SEL or L_{AE} for A-weighted sounds) combines both of these characteristics into a single metric.

SEL is a composite metric that represents both the intensity of a sound and its duration. Mathematically, the mean square sound pressure is computed over the duration of the event, then multiplied by the duration in seconds, and the resultant product is turned into a sound level. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. Table C-1 shows SEL values corresponding to representative aircraft in the specified power settings and aircraft configurations.

Table C-1. Representative Sound Exposure Levels

Aircraft (engine type)	Power Setting	Power Unit	SEL Values (in dBA) At Varying Distances (in feet)				
			500	1,000	2,000	5,000	10,000
Takeoff/Departure Operations (at 300 knots airspeed)							
A-10A	6200	NF	102.6	96.2	88.5	76.9	68.3
B-1	97.5%	RPM	129.5	123.1	116.5	107.3	99.3
F-15 (P220)	90%	NC	117.3	112	106.1	97	88.4
F-16 (P229)	93%	NC	116.5	110.8	104.6	95	86.3
F-22	100%	ETR	124.2	118.7	112.7	103.5	95.2
Landing/Arrival Operations (at 160 knots airspeed)							
A-10A	5225	NF	97.9	91.5	83.3	67	55
B-1	90%	RPM	103.4	98.3	92.7	83.4	74.4
F-15 (P220)	75%	NC	94.2	89.2	83.6	74.9	66.9
F-16 (P229)	83.5%	NC	97.4	92.1	86.3	76.9	68.2
F-22	43%	ETR	114.9	109.3	103.1	93.5	84.5

Key: Engine Units of Power: ETR = engine thrust ratio; NC = engine core revolutions per minute; NF = engine fan revolutions per minute; RPM = revolutions per minute

Source: SELCalc2 (Flyover Noise Calculator), Using NoiseMap 6/7 and Maximum Omega10 Result as the defaults.

C.1.2.2 Day-Night Average Sound Level

Noise tends to be more intrusive at night than during the day. This effect is accounted for by applying a 10 dB penalty to events that occur after 10:00 P.M. and before 7:00 A.M. If the equivalent continuous sound pressure level (L_{eq}) is computed over a 24-hour period with this nighttime penalty applied, the result is the DNL. DNL is the community noise metric recommended by the U.S. Environmental Protection Agency (USEPA) (USEPA 1974) and has been adopted by most Federal agencies (FICON 1992). It has been well established that DNL correlates well with long-term community response to noise (Finegold et al. 1994; Schultz 1978).

DNL accounts for the total, or cumulative, noise impact at a given location, and for this reason is often referred to as a "cumulative" metric. It was noted earlier that, for impulsive sounds, such as sonic booms, C-weighting is more appropriate than A-weighting. DNL computed with C-weighting is denoted CDNL or L_{Cdn}. This procedure has been standardized, and impact interpretive criteria similar to those for DNL have been developed (CHABA 1981).

C.1.2.3 Onset-Adjusted Monthly Day-Night Average Sound Level

Aircraft operations in military training airspace generate a noise environment somewhat different from other community noise environments. Overflights are sporadic, occurring at random times and varying from day to day and week to week. This situation differs from most community noise environments, in which noise tends to be continuous or patterned. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-airspeed flyover can have a rather sudden onset.

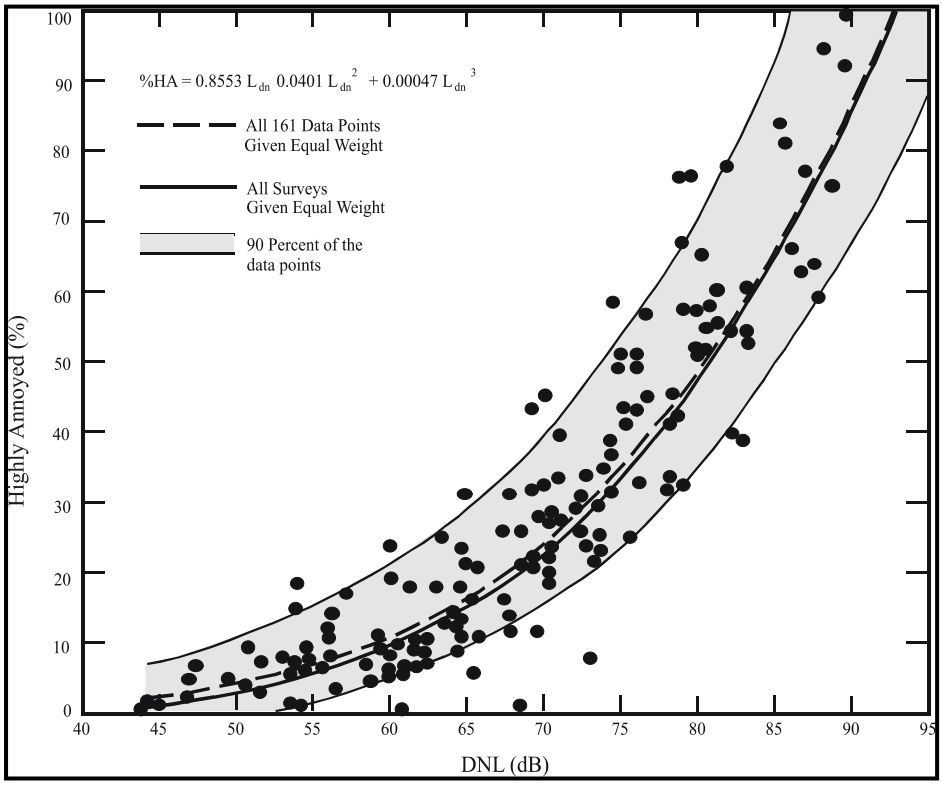
To represent these differences, the conventional DNL metric is adjusted to account for the "surprise" effect of the sudden onset of aircraft noise events on humans (Plotkin et al. 1987; Stusnick et al. 1992, 1993). For aircraft exhibiting a rate of increase in sound level (called onset rate) of from 15 to 150 dB per second, an adjustment or penalty ranging from 0 to 11 dB is added to the normal SEL. Onset rates above 150 dB per second require an 11 dB penalty, while onset rates below 15 dB per second require no adjustment. The DNL is then determined in the same manner as for conventional aircraft noise events and is designated as onset-rate adjusted day-night average sound level (abbreviated L_{dnmr}).

Because of the irregular occurrences of aircraft operations, the number of average daily operations is determined by using the calendar month with the highest number of operations. The monthly average is denoted L_{dnmr}. Noise levels are calculated the same way for both DNL and L_{dnmr}. L_{dnmr} is interpreted by the same criteria as used for DNL.

C.1.3 NOISE IMPACT

C.1.3.1 Community Reaction

Studies of long-term community annoyance to numerous types of environmental noise show that DNL correlates well with the annoyance. Schultz (1978) showed a consistent relationship between DNL and annoyance. Shultz's original curve fit (Figure C-2) shows that there is a remarkable consistency in results of attitudinal surveys which relate the percentages of groups of people who express various degrees of annoyance when exposed to different DNL.



Source: Schultz 1978.

Figure C-2. Community Surveys of Noise Annoyance

Another study reaffirmed this relationship (Fidell et al. 1989). Figure C-3 shows an updated form of the curve fit (Finegold et al. 1994) in comparison with the original. The updated fit, which does not differ substantially from the original, is the current preferred form. In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise. For example, individuals with autism are often very strongly affected by sudden noises (Tang et al. 2002). Persons with autism often report experiencing oversensitivity to noise and are often particularly sensitive to high-pitched or sudden onset noises (Grandin 1991). Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using DNL.

As noted earlier for SEL, DNL does not represent the sound level heard at any particular time, but rather represents the total sound exposure. DNL accounts for the sound level of individual noise events, the duration of those events, and the number of events. Its use is endorsed by the scientific community (ANSI 1980, 1988, 2005; FICON 1992; FICUN 1980; USEPA 1974).

While DNL is the best metric for quantitatively assessing cumulative noise impact, it does not lend itself to intuitive interpretation by non-experts. Accordingly, it is common for environmental noise analyses to include other metrics for illustrative purposes. A general indication of the noise environment can be presented by noting the maximum sound levels that can occur and the number of times per day noise events will be loud enough to be heard. Use of other metrics as supplements to DNL has been endorsed by Federal agencies (FICON 1992).

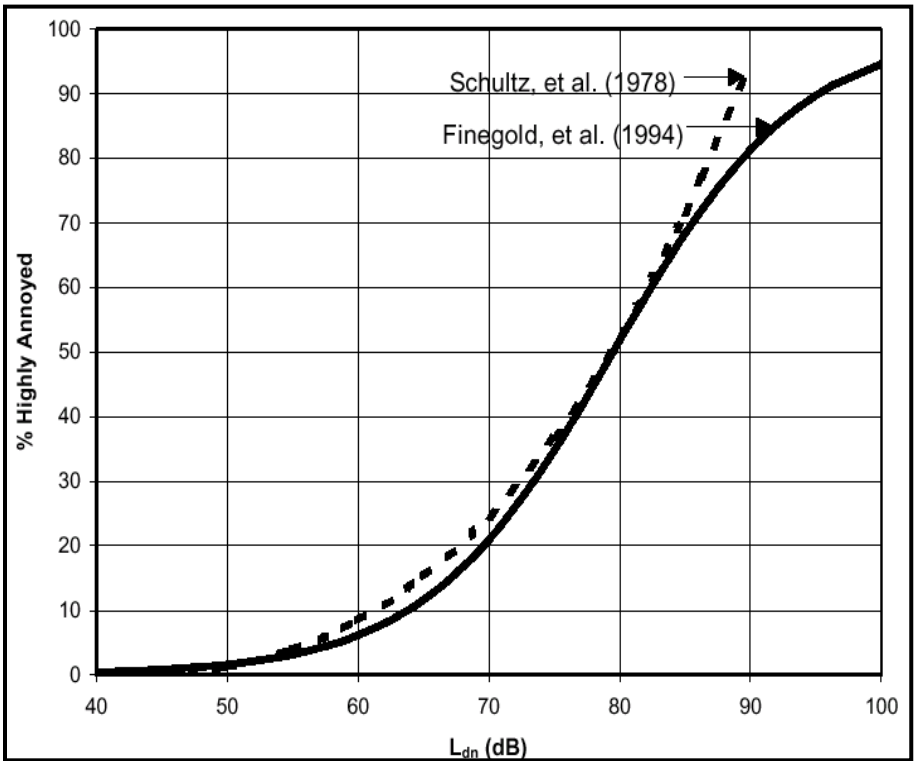


Figure C-3. Response of Communities to Noise; Comparison of Original (Schultz 1978) and Current (Finegold et al. 1994) Curve Fits

The Schultz curve is generally applied to annual average DNL. L_{dnmr} was previously described and presented as being appropriate for quantifying noise in military airspace. The Schultz curve is used with L_{dnmr} as the noise metric. L_{dnmr} is always equal to or greater than DNL, so impact is generally higher than would have been predicted if the onset rate and busiest-month adjustments were not accounted for.

There are several points of interest in the noise-annoyance relation. The first is DNL of 65 dB. This is a level most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like aviation, which do cause noise. Areas exposed to DNL above 65 dB are generally not considered suitable for residential use. The second is DNL of 55 dB, which was identified by USEPA as a level "...requisite to protect the public health and welfare with an adequate margin of safety" (USEPA 1974), which is essentially a level below which adverse impact is not expected. The third is DNL of 75 dB. This is the lowest level at which adverse health effects could be credible (USEPA 1974). The very high annoyance levels correlated with DNL of 75 dB make such areas unsuitable for residential land use. Table C-2 shows the relation between annoyance and DNL.

Table C-2. Relation Between Annoyance and DNL

dB DNL	Percent (%) Highly Annoyed
45	0.83
50	1.66
55	3.31
60	6.48
65	12.29
70	22.10

C.1.3.2 Land Use Compatibility

As noted above, the inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, when a community is considered as a whole, its overall reaction to noise can be represented with a high degree of confidence. As described above, the best noise exposure metric for this correlation is the DNL or L_{dnmr} for military overflights.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise (FICUN) published guidelines (FICUN 1980) relating DNL to compatible land uses. This committee was composed of representatives from DoD, the U.S. Department of Transportation, the U.S. Department of Housing and Urban Development, USEPA, and the Veterans Administration. Since the issuance of these guidelines, Federal agencies have generally adopted these guidelines for their noise analyses.

Following the lead of the committee, DoD and FAA adopted the concept of land use compatibility as the accepted measure of aircraft noise effect. The FAA included the committee's guidelines in the Federal Aviation Regulations (DOT 1984). These guidelines are reprinted in Table C-3, along with the explanatory notes included in the regulation. Although these guidelines are not mandatory (note the footnote "*" in the table), they provide the best means for determining noise impact in airport communities. In general, residential land uses normally are not compatible with outdoor DNL values above 65 dB, and the extent of land areas and populations exposed to DNL of 65 dB and higher provides the best means for assessing the noise impacts of alternative aircraft actions. In some cases a change in noise level, rather than an absolute threshold, may be a more appropriate measure of impact.

Table C-3. Land Use Compatibility, Noise Exposure, and Accident Potential

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65–69 dB	70–74 dB	75–79 dB	80+ dB
10	**Residential**							
11	Household units							
11.11	Single units; detached	N	N	Y[a]	A[k]	B[k]	N	N
11.12	Single units; semidetached	N	N	N	A[k]	B[k]	N	N
11.13	Singe units; attached row	N	N	N	A[k]	B[k]	N	N
11.21	Two units; side-by-side	N	N	N	A[k]	B[k]	N	N
11.22	Two units; one above the other	N	N	N	A[k]	B[k]	N	N
11.31	Apartments; walk up	N	N	N	A[k]	B[k]	N	N
11.32	Apartments; elevator	N	N	N	A[k]	B[k]	N	N
12	Group quarters	N	N	N	A[k]	B[k]	N	N
13	Residential hotels	N	N	N	A[k]	B[k]	N	N
14	Mobile home parks or courts	N	N	N	N	N	N	N
15	Transient lodgings	N	N	N	A[k]	B[k]	C[k]	N
16	Other residential	N	N	N[a]	A[k]	B[k]	N	N
20	**Manufacturing**							
21	Food and kindred products; manufacturing	N	N[b]	Y	Y	Y[l]	Y[m]	Y[n]
22	Textile mill products; manufacturing	N	N[b]	Y	Y	Y[l]	Y[m]	Y[n]
23	Apparel and other finished products made from fabrics, leather, and similar materials; manufacturing	N	N	N[b]	Y	Y[l]	Y[m]	Y[n]

Table C-3. Land Use Compatibility, Noise Exposure, and Accident Potential (Continued)

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB
24	Lumber and wood products (except furniture); manufacturing	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
25	Furniture and fixtures; manufacturing	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
26	Paper and allied products; manufacturing	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
27	Printing, publishing, and allied industries	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
28	Chemicals and allied products; manufacturing	N	N	N[b]	Y	Y[l]	Y[m]	Y[n]
29	Petroleum refining and related industries	N	N	N	Y	Y[l]	Y[m]	Y[n]
30	**Manufacturing**							
31	Rubber and misc. plastic products; manufacturing	N	N[b]	N[b]	Y	Y[l]	Y[m]	Y[n]
32	Stone, clay and glass products; manufacturing	N	N[b]	Y	Y	Y[l]	Y[m]	Y[n]
33	Primary metal industries	N	N[b]	Y	Y	Y[l]	Y[m]	Y[n]
34	Fabricated metal products; manufacturing	N	N[b]	Y	Y	Y[l]	Y[m]	Y[n]
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks; manufacturing	N	N	N[b]	Y	A	B	N
39	Miscellaneous manufacturing	N	Y[b]	Y[b]	Y	Y[l]	Y[m]	Y[n]
40	**Transportation, Communications, and Utilities**							
41	Railroad, rapid rail transit, and street railroad transportation	N[c]	Y[d]	Y	Y	Y[l]	Y[m]	Y[n]
42	Motor vehicle transportation	N[c]	Y	Y	Y	Y[l]	Y[m]	Y[n]
43	Aircraft transportation	N[c]	Y[d]	Y	Y	Y[l]	Y[m]	Y[n]
44	Marine craft transportation	N[c]	Y[d]	Y	Y	Y[l]	Y[m]	Y[n]
45	Highway and street right-of-way	N[c]	Y	Y	Y	Y[l]	Y[m]	Y[n]
46	Automobile parking	N[c]	Y[d]	Y	Y	Y[l]	Y[m]	Y[n]
47	Communications	N[c]	Y[d]	Y	Y	A[o]	B[o]	N
48	Utilities	N[c]	Y[d]	Y	Y	Y	Y[l]	Y[m]
49	Other transportation communications and utilities	N[c]	Y[d]	Y	Y	A[o]	B[o]	N
50	**Trade**							
51	Wholesale trade	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
52	Retail trade-building materials, hardware and farm equipment	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
53	Retail trade-general merchandise	N[b]	N[b]	Y[b]	Y	A	B	N
54	Retail trade-food	N[b]	N[b]	Y[b]	Y	A	B	N
55	Retail trade-automotive, marine craft, aircraft and accessories	N[b]	N[b]	Y[b]	Y	A	B	N
56	Retail trade-apparel and accessories	N[b]	N[b]	Y[b]	Y	A	B	N
57	Retail trade-furniture, home furnishings and equipment	N[b]	N[b]	Y[b]	Y	A	B	N
58	Retail trade-eating and drinking establishments	N	N	N[b]	Y	A	B	N
59	Other retail trade	N	N[b]	Y[b]	Y	A	B	N
60	**Services**							
61	Finance, insurance, and real estate services	N	N	Y[f]	Y	A	B	N
62	Personal services	N	N	Y[f]	Y	A	B	N

Table C-3. Land Use Compatibility, Noise Exposure, and Accident Potential (Continued)

Land Use		Accident Potential Zones			Noise Zones			
SLUCM No.	Name	Clear Zone	APZ I	APZ II	65-69 dB	70-74 dB	75-79 dB	80+ dB
62.4	Cemeteries	N	Y[g]	Y[g]	Y	Y[l]	Y[m]	Y[n,b,a]
63	Business services	N	Y[h]	Y[h]	Y	A	B	N
64	Repair services	N	Y[b]	Y	Y	Y[l]	Y[m]	Y[n]
65	Professional services	N	N	Y[f]	Y	A	B	N
65.1	Hospitals, nursing homes	N	N	N	A*	B*	N	N
65.1	Other medical facilities	N	N	N	Y	A	B	N
66	Contract construction services	N	Y[f]	Y	Y	A	B	N
67	Governmental services	N[f]	N	Y[f]	Y*	A*	B*	N
68	Educational services	N	N	N	A*	B*	N	N
69	Miscellaneous services	N	N[b]	Y[b]	Y	A	B	N
70	**Cultural, Entertainment and Recreational**							
71	Cultural activities (including churches)	N	N	N[b]	A*	B*	N	N
71.2	Nature exhibits	N	Y[b]	Y	Y*	N	N	N
72	Public assembly	N	N	N	Y	N	N	N
72.1	Auditoriums, concert halls	N	N	N	A	B	N	N
72.11	Outdoor music shell, amphitheatres	N	N	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	N	N	N	Y[q]	Y[q]	N	N
73	Amusements	N	N	Y[h]	Y	Y	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	N	Y[h,i,j]	Y	Y*	A*	B*	N
75	Resorts and group camps	N	N	N	Y*	Y*	N	N
76	Parks	N	Y[h]	Y[h]	Y*	Y*	N	N
79	Other cultural, entertainment, and recreation	N[i]	Y[i]	Y[i]	Y*	Y*	N	N
80	**Resources Production and Extraction**							
81	Agriculture (except livestock)	Y[p]	Y	Y	Y[r]	Y[s]	Y[t]	Y[t,u]
81.5 to 81.7	Livestock farming and animal breeding	N	Y	Y	Y[r]	Y[s]	Y[t]	Y[t,u]
82	Agricultural-related activities	N	Y[e]	Y	Y[r]	Y[s]	N	N
83	Forestry activities and related services	N[e]	Y	Y	Y[r]	Y[s]	Y[t]	Y[t,u]
84	Fishing activities and related services	N[e]	Y[e]	Y	Y	Y	Y	Y
85	Mining activities and related services	N	Y[e]	Y	Y	Y	Y	Y
89	Other resources production and extraction	N	Y[e]	Y	Y	Y	Y	Y

[a] Suggested maximum density of 1–2 dwelling units per acre possibly increased under a Planned Unit Development where maximum lot coverage is less than 20 percent.

[b] Within each land use category, uses exist where further definition may be needed due to the variation of densities in people and structures. Shopping malls and shopping centers are considered incompatible in any accident potential zone (APZ).

[c] The placing of structures, buildings, or aboveground utility lines in the clear zone is subject to severe restrictions. In a majority of the clear zones, these items are prohibited. See Air Force Instruction (AFI) 32-7063 and Air Force Manual (AFMAN) 32-1123 for specific guidance.

[d] No passenger terminals and no major aboveground transmission lines in APZ I.

[e] Factors to be considered: labor intensity, structural coverage, explosive characteristics, and air pollution.

[f] Low-intensity office uses only. Meeting places, auditoriums, etc., are not recommended.

[g] Excludes chapels.

[h] Facilities must be low intensity.

[i] Clubhouse not recommended.

[j] Areas for gatherings of people are not recommended.

[k] Footnote *k* as applied to noise level reduction (NLR) designation A: Although local conditions may require residential use, it is discouraged in DNL 65–69 dB and strongly discouraged in DNL 70–74 dB. An evaluation should be conducted prior to approvals, indicating that a demonstrated community need for residential use would not be met if development were prohibited in these zones, and that there are no viable alternative locations.

Footnote *k* as applied to NLR designation B: Where the community determines the residential uses must be allowed, measures to achieve outdoor to indoor NLR for DNL 65–69 dB and DNL 70–74 dB should be incorporated into building codes and considered in individual approvals.

Footnote *k* as applied to NLR designation C: NLR criteria will not eliminate outdoor noise problems. However, building location and site planning and design and use of berms and barriers can help mitigate outdoor exposure, particularly from near ground-level sources. Measures that reduce outdoor noise should be used whenever practical in preference to measures that only protect interior spaces.

[l] Measures to achieve the same NLR as required for facilities in the DNL 65–69 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

[m] Measures to achieve the same NLR as required for facilities in the DNL 70–74 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

[n] Measures to achieve the same NLR as required for facilities in the DNL 75–79 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

[o] If noise-sensitive, use indicated NLR; if not, the use is compatible.

[p] No buildings.

[q] Land use is compatible provided special sound reinforcement systems are installed.

[r] Residential buildings require the same NLR required for facilities in the DNL 65–69 dB range.

[s] Residential buildings require the same NLR required for facilities in the DNL 70–74 dB range.

[t] Residential buildings are not permitted.

[u] Land use is not recommended. If the community decides the use is necessary, hearing protection devices should be worn by personnel.

Key: SLUCM = Standard Land Use Coding Manual, U.S. Department of Transportation; Y = Yes; land use and related structures are compatible without restriction; N = No; land use and related structures are not compatible and should be prohibited; A, B, or C = Land use and related structures generally compatible; measures to achieve noise level reduction of A (25 dB), B (30 dB), or C (35 dB) should be incorporated into the design and construction of structures; A*, B*, or C* = Land use generally compatible with noise level reduction. However, measures to achieve an overall noise level reduction do not necessarily solve noise difficulties and additional evaluation is warranted. See appropriate footnotes; * = The designation of these uses as "compatible" in this zone reflects individual Federal agency and program consideration of general cost and feasibility factors, as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.

C.2 NOISE EFFECTS

The discussion in the previous section presented the global effect of noise on communities. The following sections describe particular noise effects. These effects include non-auditory health effects, annoyance, speech interference, sleep disturbance, noise-induced hearing impairment, noise effects on animals and wildlife, noise effects on property values, and noise effects on structures, terrain, and cultural resources.

C.2.1 ANNOYANCE

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the USEPA as any negative subjective reaction on the part of an individual or group (USEPA 1974). As noted in the discussion of DNL above, community annoyance is best measured by that metric.

Because the USEPA Levels Document (USEPA 1974) identified DNL of 55 dB as ". . . requisite to protect public health and welfare with an adequate margin of safety," it is commonly assumed that 55 dB should be adopted as a criterion for community noise analysis. From a noise exposure perspective, that would be an ideal selection. However, financial resources are generally not available to achieve that goal. Most agencies have identified DNL of 65 dB as a criterion that protects those most impacted by noise, and that can often be achieved on a practical basis (FICON 1992). This corresponds to about 12 percent of the exposed population being highly annoyed.

Although DNL of 65 dB is widely used as a benchmark for significant noise impact, and is often an acceptable compromise, it is not a statutory limit, and it is appropriate to consider other

thresholds in particular cases. Local ordinances and regulations have been adopted by many municipal governments to prevent civilian development near military installations that would be incompatible with noise generated by military operations. The decision to adopt such measures, and the specific content of the ordinances and regulations, is up to the municipal government. In many cases, the 65 dB DNL noise contour line is adopted as the threshold level above which land use restrictions are invoked.

C.2.2 SPEECH INTERFERENCE

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Speech is an acoustic signal characterized by rapid fluctuations in sound level and frequency pattern. It is essential for optimum speech intelligibility to recognize these continually shifting sound patterns. Not only does noise diminish the ability to perceive the auditory signal, but it also reduces a listener's ability to follow the pattern of signal fluctuation. In general, interference with speech communication occurs when intrusive noise exceeds about 60 dB (FICON 1992).

Indoor speech interference can be expressed as a percentage of sentence intelligibility among two people speaking in relaxed conversation approximately 3 feet apart in a typical living room or bedroom (USEPA 1974). The percentage of sentence intelligibility is a non-linear function of the (steady) indoor background A-weighted sound level. Such a curve-fit yields 100 percent sentence intelligibility for background levels below 57 dB and yields less than 10 percent intelligibility for background levels above 73 dB. The function is especially sensitive to changes in sound level between 65 dB and 75 dB. As an example of the sensitivity, a 1 dB increase in background sound level from 70 dB to 71 dB yields a 14 percent decrease in sentence intelligibility. The sensitivity of speech interference to noise at 65 dB and above is consistent with the criterion of DNL 65 dB generally taken from the Schultz curve. This is consistent with the observation that speech interference is the primary cause of annoyance.

Classroom Criteria. The effect of aircraft noise on children is a controversial area. Certain studies indicate that, in certain situations, children are potentially more sensitive to noise compared to adults. For example, adults average roughly 10 percent better than young children on speech intelligibility tests in high-noise environments (ASA 2000). Some studies indicate that noise negatively impacts classroom learning (e.g., Shield and Dockrell 2008).

In response to noise-specific and other environmental studies, Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (1997), requires Federal agencies to ensure that their policies, programs, and activities address environmental health and safety risks and to identify any disproportionate risks to children. While the issue of noise impacts on children's learning is not fully settled, in May 2009, the American National Standards Institute (ANSI) published a classroom acoustics standard entitled "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools" (ANSI 2002). At present, complying with the standard is voluntary in most locations. Essentially, the criteria states that when the noisiest hour is dominated by noise from such sources as aircraft, the limits for most classrooms are an hourly average A-weighted sound level of 40 dB, and the A-weighted sound level must not exceed 40 dB for more than 10 percent of the hour. For schools located near airfields, indoor noise levels would have to be lowered by 35–45 dBA relative to outdoor levels (ANSI 2009).

C.2.3 SLEEP DISTURBANCE

Sleep disturbance is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

Sleep disturbance may be measured in either of two ways. "Arousal" represents actual awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat higher noise level than does a change in sleep stage.

An analysis sponsored by the U.S. Air Force (USAF) summarized 21 published studies concerning the effects of noise on sleep (Pearsons et al. 1989). The analysis concluded that a lack of reliable in-home studies, combined with large differences among the results from the various laboratory studies, did not permit development of an acceptably accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced. None of the laboratory studies were of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions. An extensive study of sleep interference in people's own homes (Ollerhead et al. 1992) showed very little disturbance from aircraft noise.

There is some controversy associated with these studies, so a conservative approach should be taken in judging sleep interference. Based on older data, the USEPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference (USEPA 1974). Assuming an outdoor-to-indoor noise level reduction of 20 dB for typical dwelling units, this corresponds to an outdoor DNL of 65 dB as minimizing sleep interference.

A 1984 publication reviewed the probability of arousal or behavioral awakening in terms of SEL (Kryter 1984). Figure C-4, extracted from Figure 10.37 of Kryter (1984), indicates that an indoor SEL of 65 dB or lower should awaken less than 5 percent of those exposed. These results do not include any habituation over time by sleeping subjects. Nevertheless, this provides a reasonable guideline for assessing sleep interference and corresponds to similar guidance for speech interference, as noted above.

It was noted in the early sleep disturbance research that the controlled laboratory studies did not account for many factors that are important to sleep behavior, such as habituation to the environment and previous exposure to noise and awakenings from sources other than aircraft noise. In the early 1990s, field studies were conducted to validate the earlier laboratory work. The most significant finding from these studies was that an estimated 80 to 90 percent of sleep disturbances were not related to individual outdoor noise events, but were instead the result of indoor noise sources and other non-noise-related factors. The results showed that there was less of an effect of noise on sleep in real-life conditions than had been previously reported from laboratory studies.

The interim Federal Interagency Committee on Noise (FICON) dose-response curve that was recommended for use in 1992 was based on the most pertinent sleep disturbance research that was conducted through the 1970s, primarily in laboratory settings. After that time, considerable field research was conducted to evaluate the sleep effects in people's normal, home environment. Laboratory sleep studies tend to show higher values of sleep disturbance than field studies because people who sleep in their own homes are habituated to their environment and, therefore, do not wake up as easily (FICAN 1997).

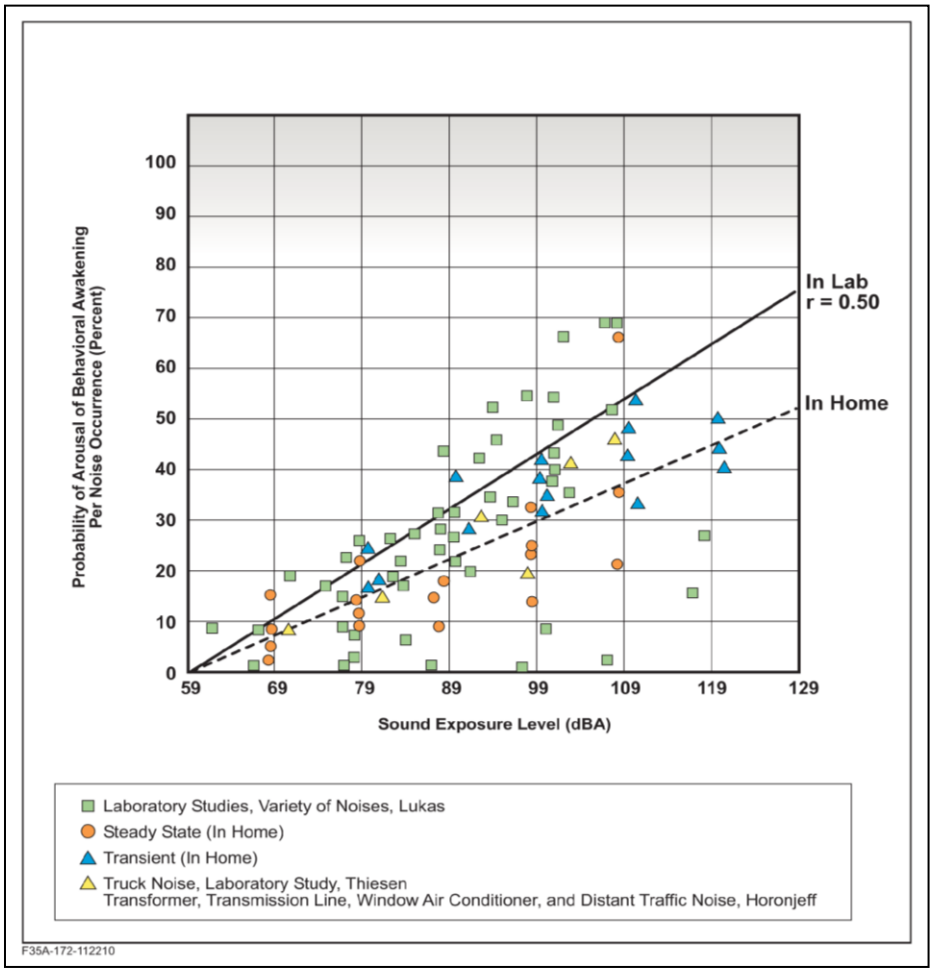


Figure C-4. Plot of Sleep Awakening Data Versus Indoor SEL

Based on the new information, the Federal Interagency Committee on Aircraft Noise (FICAN) updated its recommended dose-response curve in 1997, depicted as the lower curve on Figure C-5. This figure is based on the results of three field studies (Ollerhead et al. 1992; Fidell et al. 1994, 1995a, 1995b), along with the datasets from six previous field studies.

The new relationship represents the higher end, or upper envelope, of the latest field data. It should be interpreted as predicting the "maximum percent of the exposed population expected to be behaviorally awakened" or the "maximum percent awakened" for a given residential population. According to this relationship, a maximum of 3 percent of people would be awakened at an indoor SEL of 58 dB, compared to 10 percent using the 1992 curve. An indoor SEL of 58 dB is equivalent to outdoor SELs of 73 and 83 dB, respectively, assuming 15 and 25 dB noise level reduction from outdoor to indoor with windows open and closed, respectively.

The FICAN 1997 curve is represented by the following equation:

$$\textbf{Percent Awakenings} = 0.0087 \times [\text{SEL} - 30]^{1.79}$$

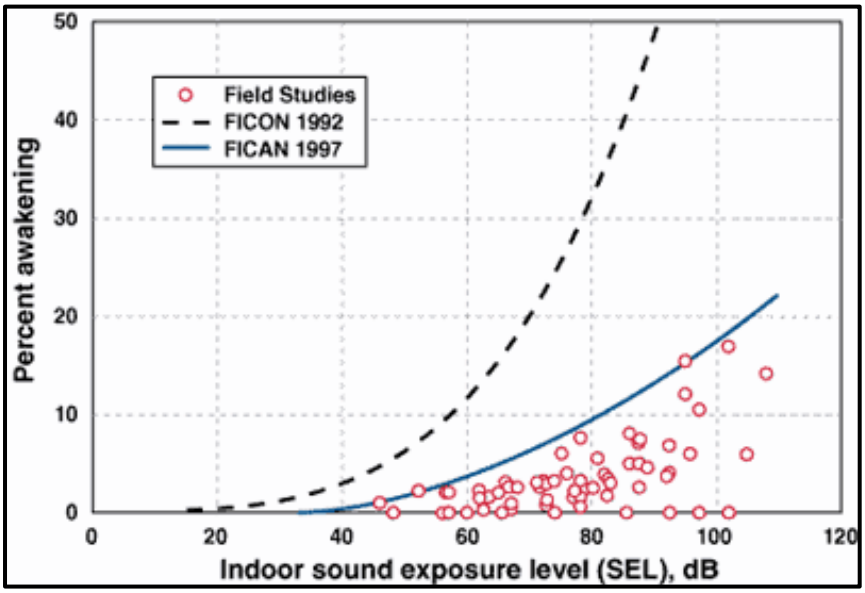


Figure C-5. FICAN's 1997 Recommended Sleep Disturbance Dose-Response Relationship

Note the relatively low percentage of awakenings to fairly high noise levels. People think they are awakened by a noise event, but usually the reason for awakening is otherwise. For example, a 1992 United Kingdom Civil Aviation Authority study found the average person was awakened about 18 times per night for reasons other than exposure to an aircraft noise – some of these awakenings are due to the biological rhythms of sleep and some to other reasons that were not correlated with specific aircraft events.

In July 2008, ANSI and the Acoustical Society of America (ASA) published a method to estimate the percent of the exposed population that might be awakened by multiple aircraft noise events based on statistical assumptions about the probability of awakening (or not awakening) (ANSI 2008). This method relies on probability theory rather than direct field research/experimental data to account for multiple events.

Figure C-6 depicts the awakenings data that form the basis and equations of ANSI (2008). The curve labeled 'Eq. (B1)' is the relationship between noise and awakening endorsed by FICAN in 1997. The ANSI-recommended curve labeled 'Eq. (1)' quantifies the probability of awakening for a population of sleepers who are exposed to an outdoor noise event as a function of the associated indoor SEL in the bedroom. This curve was derived from studies of behavioral awakenings associated with noise events in "steady state" situations where the population has been exposed to the noise long enough to be habituated. The data points on Figure C-6 come from these studies. Unlike the FICAN curve, the ANSI 2008 curve represents the average of the field research data points.

In December 2008, FICAN recommended the use of this new estimation procedure for future analyses of behavioral awakenings from aircraft noise. In that statement, FICAN also recognized that additional sleep disturbance research is underway by various research organizations, and results of that work may result in additional changes to FICAN's position. Until that time, FICAN recommends the use of ANSI (2008).

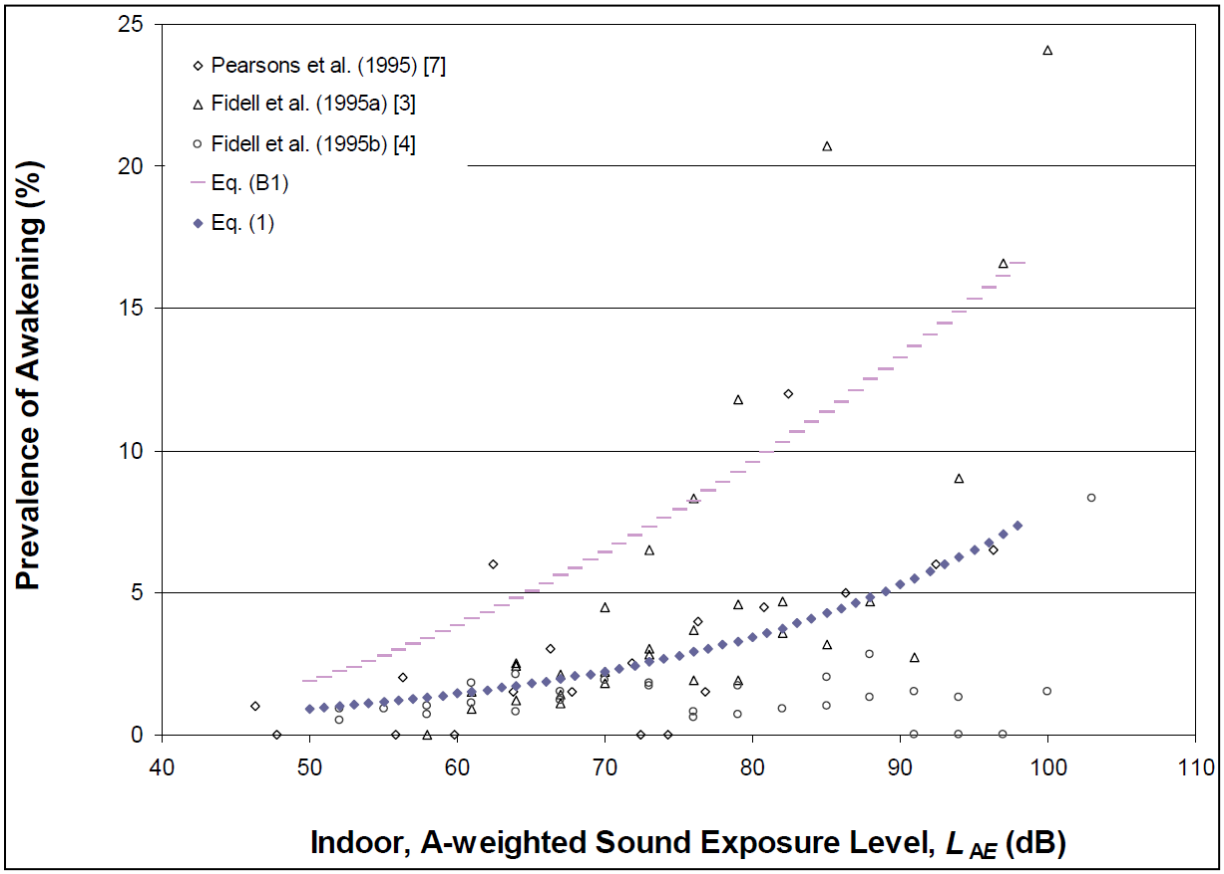


Figure C-6. Relation Between Indoor SEL and Percentage of Persons Awakened as Stated in ANSI/ASA S12.9-2008/Part 6 (ANSI 2008)

C.2.4 NOISE-INDUCED HEARING IMPAIRMENT

Residents in surrounding communities express concerns regarding the effects of aircraft noise on hearing. This section provides a brief overview of hearing loss caused by noise exposure. The goal is to provide a sense of perspective as to how aircraft noise (as experienced on the ground) compares to other activities that are often linked with hearing loss.

Hearing loss is generally interpreted as a decrease in the ear's sensitivity or acuity to perceive sound, i.e., a shift in the hearing threshold to a higher level. This change can either be a Temporary Threshold Shift (TTS) or a Permanent Threshold Shift (PTS) (Berger et al. 1995). TTS can result from exposure to loud noise over a given amount of time, yet the hearing loss is not necessarily permanent. An example of TTS might be a person attending a loud music concert. After the concert is over, the person may experience a threshold shift that may last several hours, depending upon the level and duration of exposure. While experiencing TTS, the person becomes less sensitive to low-level sounds, particularly at certain frequencies in the speech range (typically near 4,000 Hz). Normal hearing ability eventually returns, as long as the person has enough time to recover within a relatively quiet environment.

PTS usually results from repeated exposure to high noise levels, where the ears are not given adequate time to recover from the strain and fatigue of exposure. A common example of PTS is the result of working in a loud environment such as a factory. It is important to note that a temporary shift (TTS) can eventually become permanent (PTS) over time with continuous exposure to high noise levels. Thus, even if the ear is given time to recover from TTS, repeated

occurrence of TTS may eventually lead to permanent hearing loss. The point at which a TTS results in a PTS is difficult to identify and varies with a person's sensitivity.

Considerable data on hearing loss have been collected and analyzed by the scientific/medical community. It has been well established that continuous exposure to high noise levels will damage human hearing (USEPA 1978). The Occupational Safety and Health Administration regulation of 1971 standardizes the limits on workplace noise exposure for protection from hearing loss as an average level of 90 dB over an 8-hour work period or 85 dB over a 16-hour period (the average level is based on a 5 dB decrease per doubling of exposure time) (DoL 1971). Even the most protective criterion (no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency, 4,000 Hz, after a 40-year exposure) is an average sound level of 70 dB over a 24-hour period.

The USEPA established 75 dB for an 8-hour exposure and 70 dB for a 24-hour exposure as the average noise level standard requisite to protect 96 percent of the population from greater than a 5 dB PTS (USEPA 1978). The National Academy of Sciences Committee on Hearing, Bioacoustics, and Biomechanics identified 75 dB as the minimum level at which hearing loss may occur (CHABA 1977). Finally, the World Health Organization has concluded that environmental and leisure-time noise below an $L_{eq}24$ value of 70 dB "will not cause hearing loss in the large majority of the population, even after a lifetime of exposure" (WHO 2000).

C.2.4.1 Hearing Loss and Aircraft Noise

The 1982 USEPA guidelines report specifically addresses the criteria and procedures for assessing the noise-induced hearing loss in terms of the Noise-Induced Permanent Threshold Shift (NIPTS), a quantity that defines the permanent change in hearing level, or threshold, caused by exposure to noise (USEPA 1982). This effect is also described as Potential Hearing Loss. Numerically, the NIPTS is the change in threshold averaged over the frequencies 0.5, 1, 2, and 4 kHz that can be expected from daily exposure to noise over a normal working lifetime of 40 years, with the exposure beginning at an age of 20 years. A grand average of the NIPTS over time (40 years) and hearing sensitivity (10 to 90 percentiles of the exposed population) is termed the Average NIPTS. The Average NIPTS that can be expected for noise exposure as measured by the DNL metric is given in Table C-4.

Table C-4. Average NIPTS and 10th Percentile NIPTS as a Function of DNL

dB DNL	Average NIPTS dB[a]	10th Percentile NIPTS dB[a]
75–76	1.0	4.0
76–77	1.0	4.5
77–78	1.6	5.0
78–79	2.0	5.5
79–80	2.5	6.0
80–81	3.0	7.0
81–82	3.5	8.0
82–83	4.0	9.0
83–84	4.5	10.0
84–85	5.5	11.0
85–86	6.0	12.0
86–87	7.0	13.5
87–88	7.5	15.0
88–89	8.5	16.5
89–90	9.5	18.0

[a] Rounded to the nearest 0.5 dB.

For example, for a noise exposure of 80 dB DNL, the expected lifetime average value of NIPTS is 2.5 dB, or 6.0 dB for the 10th percentile. Characterizing the noise exposure in terms of DNL will usually overestimate the assessment of hearing loss risk as DNL includes a 10 dB weighting factor for aircraft operations occurring between 10:00 P.M. and 7:00 A.M. If, however, flight operations between the hours of 10:00 P.M. and 7:00 A.M. account for 5 percent or less of the total 24-hour operations, the overestimation is on the order of 1.5 dB.

From a civilian airport perspective, the scientific community has concluded that there is little likelihood that the resulting noise exposure from aircraft noise could result in either a temporary or permanent hearing loss. Studies on community hearing loss from exposure to aircraft flyovers near airports showed that there is no danger, under normal circumstances, of hearing loss due to aircraft noise (Newman and Beattie 1985). The USEPA criterion ($L_{eq}24$ = 70 dBA) can be exceeded in some areas located near airports, but that is only the case outdoors. Inside a building, where people are more likely to spend most of their time, the average noise level will be much less than 70 dBA (Eldred and von Gierke 1993). Eldred and von Gierke also report that "several studies in the United States, Japan, and the United Kingdom have confirmed the predictions that the possibility for permanent hearing loss in communities, even under the most intense commercial take-off and landing patterns, is remote."

With regard to military airbases, as individual aircraft noise levels are increasing with the introduction of new aircraft, a 2009 DoD policy directive requires that hearing loss risk be estimated for the at risk population, defined as the population exposed to DNL greater than or equal to 80 dB (DoD 2009). Specifically, DoD components are directed to "use the 80 Day-Night A-Weighted (DNL) noise contour to identify populations at the most risk of potential hearing loss." This does not preclude populations outside the 80 dB DNL contour (i.e., at lower exposure levels) from being at some degree of risk of hearing loss. However, the analysis should be restricted to populations within this contour area, including residents of on-base housing. The exposure of workers inside the base boundary area should be considered occupational and evaluated using the appropriate DoD component regulations for occupational noise exposure.

With regard to military airspace activity, studies have shown conflicting results. A 1995 laboratory study measured changes in human hearing from noise representative of low-flying aircraft on Military Training Routes (Nixon et al. 1993). The potential effects of aircraft flying along Military Training Routes is of particular concern because maximum overflight noise levels can exceed 115 dB, with rapid increases in noise levels exceeding 30 dB per second. In this study, participants were first subjected to four overflight noise exposures at A-weighted levels of 115 dB to 130 dB. Fifty percent of the subjects showed no change in hearing levels, 25 percent had a temporary 5 dB *increase* in sensitivity (the people could hear a 5 dB wider range of sound than before exposure), and 25 percent had a temporary 5 dB decrease in sensitivity (the people could hear a 5 dB narrower range of sound than before exposure). In the next phase, participants were subjected to a single overflight at a maximum level of 130 dB for eight successive exposures, separated by 90 seconds or until a temporary shift in hearing was observed. The TTSs showed an increase in sensitivity of up to 10 dB.

In another study of 115 test subjects between 18 and 50 years old in 1999, TTSs were measured after laboratory exposure to military low-altitude flight noise (Ising et al. 1999). According to the authors, the results indicate that repeated exposure to military low-altitude flight noise with a maximum sound level (L_{max}) greater than 114 dB, especially if the noise level increases rapidly, may have the potential to cause noise-induced hearing loss in humans.

Aviation and typical community noise levels near airports are not comparable to the occupational or recreational noise exposures associated with hearing loss. Studies of aircraft noise levels associated with civilian airport activity have not definitively correlated permanent hearing impairment with aircraft activity. It is unlikely that airport neighbors will remain outside their homes 24 hours per day, so there is little likelihood of hearing loss below an average sound level of 75 dB DNL. Near military airbases, average noise levels above 75 dB may occur, and while new DoD policy dictates that NIPTS be evaluated, no research results to date have definitively related permanent hearing impairment to aviation noise.

C.2.4.2 Non-Auditory Health Effects

Studies have been conducted to determine whether correlations exist between noise exposure and cardiovascular problems, birth weight, and mortality rates. The non-auditory effect of noise on humans is not as easily substantiated as the effect on hearing. Prolonged stress is known to be a contributor to a number of health disorders. Kryter and Poza (1980) state, "It is more likely that noise-related general ill-health effects are due to the psychological annoyance from the noise interfering with normal everyday behavior, than it is from the noise eliciting, because of its intensity, reflexive response in the autonomic or other physiological systems of the body." Psychological stresses may cause a physiological stress reaction that could result in impaired health. The National Institute for Occupational Safety and Health and USEPA commissioned the Committee on Hearing, Bioacoustics and Biomechanics (CHABA) in 1981 to study whether established noise standards are adequate to protect against health disorders other than hearing defects. CHABA's conclusion was that:

> Evidence from available research reports is suggestive, but it does not provide definitive answers to the question of health effects, other than to the auditory system, of long-term exposure to noise. It seems prudent, therefore, in the absence of adequate knowledge as to whether or not noise can produce effects upon health other than damage to auditory system, either directly or mediated through stress, that insofar as feasible, an attempt should be made to obtain more critical evidence.

Since the CHABA report, there have been further studies that suggest that noise exposure may cause hypertension and other stress-related effects in adults. Near an airport in Stockholm, Sweden, the prevalence of hypertension was reportedly greater among nearby residents who were exposed to energy averaged noise levels exceeding 55 dB and maximum noise levels exceeding 72 dB, particularly older subjects and those not reporting impaired hearing ability (Rosenlund et al. 2001). A study of elderly volunteers who were exposed to simulated military low-altitude flight noise reported that blood pressure was raised by L_{max} of 112 dB and high speed level increase (Michalak et al. 1990). Yet another study of subjects exposed to varying levels of military aircraft or road noise found no significant relationship between noise level and blood pressure (Pulles et al. 1990).

Most studies of non-auditory health effects of long-term noise exposure have found that noise exposure levels established for hearing protection will also protect against any potential non-auditory health effects, at least in workplace conditions. One of the best scientific summaries of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on 22 to 24 January 1990 in Washington, D.C.:

> The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic

manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an 8-hour day).

At the 1988 International Congress on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous. Consequently, one comes to the conclusion that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem, but also any potential non-auditory health effects in the work place (von Gierke 1990).

Although these findings were specifically directed at noise effects in the workplace, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the non-auditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies that purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, two University of California, Los Angeles (UCLA) researchers apparently found a relationship between aircraft noise levels under the approach path to Los Angeles International Airport (LAX) and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the "noise-exposed" population (Meacham and Shaw 1979). Nevertheless, three other UCLA professors analyzed those same data and found no relationship between noise exposure and mortality rates (Frerichs et al. 1980).

As a second example, two other UCLA researchers used this same population near LAX to show a higher rate of birth defects for 1970 to 1972 when compared with a control group residing away from the airport (Jones and Tauscher 1978). Based on this report, a separate group at the Centers for Disease Control and Prevention performed a more thorough study of populations near Atlanta's Hartsfield International Airport for 1970 to 1972 and found no relationship in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Edmonds et al. 1979).

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-averaged sound levels below 75 dB. The potential for noise to affect physiological health, such as the cardiovascular system, has been speculated; however, no unequivocal evidence exists to support such claims (Harris 1997). Conclusions drawn from a review of health effect studies involving military low-altitude flight noise with its unusually high maximum levels and rapid rise in sound level have shown no increase in cardiovascular disease (Schwarze and Thompson 1993). Additional claims that are unsupported include flyover noise producing increased mortality rates and increases in cardiovascular death, aggravation of post-traumatic stress syndrome, increased stress, increases in admissions to mental hospitals, and adverse effects on pregnant women and fetuses (Harris 1997).

C.2.4.3 Performance Effects

The effect of noise on the performance of activities or tasks has been the subject of many studies. Some of these studies have established links between continuous high noise levels and performance loss. Noise-induced performance losses are most frequently reported in studies employing noise levels in excess of 85 dB. Little change has been found in low-noise cases. It has been cited that moderate noise levels appear to act as a stressor for more sensitive individuals performing a difficult psychomotor task. While the results of research on the general effect of periodic aircraft noise on performance have yet to yield definitive criteria, several general trends have been noted including:

- A periodic intermittent noise is more likely to disrupt performance than a steady state continuous noise of the same level. Flyover noise, due to its intermittent nature, might be more likely to disrupt performance than a steady state noise of equal level.
- Noise is more inclined to affect the quality than the quantity of work.
- Noise is more likely to impair the performance of tasks that place extreme demands on the worker.

C.2.4.4 Noise Effects on Children

In response to noise-specific and other environmental studies, Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (1997), requires Federal agencies to ensure that policies, programs, and activities address environmental health and safety risks to identify any disproportionate risks to children.

A review of the scientific literature indicates that there has not been a tremendous amount of research in the area of aircraft noise effects on children. The research reviewed does suggest that environments with sustained high background noise can have variable effects, including noise effects on learning and cognitive abilities, and reports of various noise-related physiological changes.

C.2.4.4.1 Effects on Learning and Cognitive Abilities

In "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools," (ANSI 2002), ANSI refers to studies that suggest that loud and frequent background noise can affect the learning patterns of young children (ANSI 2002). ANSI provides discussion on the relationships between noise and learning, and stipulates design requirements and acoustical performance criteria for outdoor-to-indoor noise isolation. School design is directed to be cognizant of, and responsive to, surrounding land uses and the shielding of outdoor noise from the indoor environment. The ANSI acoustical performance criteria for schools include the requirement that the 1-hour average background noise level shall not exceed 35 dBA in core learning spaces smaller than 20,000 cubic feet and 40 dBA in core learning spaces with enclosed volumes exceeding 20,000 cubic feet. This would require schools be constructed such that, in quiet neighborhoods, indoor noise levels are lowered by 15 to 20 dBA relative to outdoor levels. In schools near airports, indoor noise levels would have to be lowered by 35 to 45 dBA relative to outdoor levels (ANSI 2002).

The studies referenced by ANSI to support the new standard are not specific to jet aircraft noise and the potential effects on children. However, there are references to studies that have shown that children in noisier classrooms scored lower on a variety of tests. Excessive background noise or reverberation within schools causes interferences of communication and can therefore create an acoustical barrier to learning (ANSI 2002). Studies have been performed that contribute to the body of evidence emphasizing the importance of communication by way of the spoken language to the development of cognitive skills. The ability to read, write, comprehend, and maintain attentiveness, are, in part, based upon whether teacher communication is consistently intelligible (ANSI 2002).

Numerous studies have shown varying degrees of effects of noise on the reading comprehension, attentiveness, puzzle-solving, and memory/recall ability of children. It is generally accepted that young children are more susceptible than adults to the effects of background noise. Because of the developmental status of young children (linguistic, cognitive, and proficiency), barriers to hearing can cause interferences or disruptions in developmental evolution.

Research on the impacts of aircraft noise, and noise in general, on the cognitive abilities of school-aged children has received more attention in the last 20 years. Several studies suggest that aircraft noise can affect the academic performance of school children. Although many factors could contribute to learning deficits in school-aged children (e.g., socioeconomic level, home environment, diet, sleep patterns), evidence exists that suggests that chronic exposure to high aircraft noise levels can impair learning. Specifically, elementary school children attending schools near New York City's two airports demonstrated lower reading scores than children living farther away from the flight paths (Green et al. 1982). Researchers have found that tasks involving central processing and language comprehension (such as reading, attention, problem solving, and memory) appear to be the most affected by noise (Evans and Lepore 1993; Evans et al. 1998). It has been demonstrated that chronic exposure of first- and second-grade children to aircraft noise can result in reading deficits and impaired speech perception (i.e., the ability to hear common, low-frequency [vowel] sounds but not high frequencies [consonants] in speech) (Evans and Maxwell 1997).

The Evans and Maxwell (1997) study found that chronic exposure to aircraft noise resulted in reading deficits and impaired speech perception for first- and second-grade children. Other studies found that children residing near LAX had more difficulty solving cognitive problems and did not perform as well as children from quieter schools in puzzle-solving and attentiveness (Bronzaft 1997; Cohen et al. 1980). Children attending elementary schools in high aircraft noise areas near London's Heathrow Airport demonstrated poorer reading comprehension and selective cognitive impairments (Haines et al. 2001a, 2001b). Similar studies involving the testing of attention, memory, and reading comprehension of school children located near airports showed that their tests exhibited reduced performance results compared to those of similar groups of children who were located in quieter environments (Evans et al. 1998; Haines et al. 1998). The Haines and Stansfeld study indicated that there may be some long-term effects associated with exposure, as 1-year follow-up testing still demonstrated lowered scores for children in higher noise schools (Haines et al. 2001a, 2001b). In contrast, a 2002 study found that although children living near the old Munich airport scored lower in standardized reading and long-term memory tests than a control group, their performance on the same tests were equal to that of the control group once the airport was closed (Hygge et al. 2002).

Finally, although it is recognized that there are many factors that could contribute to learning deficits in school-aged children, there is increasing awareness that chronic exposure to high aircraft noise levels may impair learning. This awareness has led the World Health Organization (WHO 2000) and a North Atlantic Treaty Organization working group (NATO 2000) to conclude that daycare centers and schools should not be located near major sources of noise, such as highways, airports, and industrial sites.

C.2.4.4.2 Health Effects

Physiological effects in children exposed to aircraft noise and the potential for health effects have also been the focus of limited investigation. Studies in the literature include examination of blood pressure levels, hormonal secretions, and hearing loss.

As a measure of stress response to aircraft noise, blood pressure readings have been used to monitor children's health. Children who were chronically exposed to aircraft noise from a new airport near Munich, Germany, had modest (although significant) increases in blood pressure, significant increases in stress hormones, and a decline in quality of life (Evans et al. 1998). Children attending noisy schools had statistically significant average systolic and diastolic blood pressure ($p<0.03$). Systolic blood pressure means were 89.68 millimeters for children

attending schools located in noisier environments compared to 86.77 millimeters for a control group. Similarly, diastolic blood pressure means for the noisier environment group were 47.84 millimeters and 45.16 millimeters for the control group (Cohen et al. 1980).

Although the literature appears limited, studies focused on the wide range of potential effects of aircraft noise on school children have also investigated hormonal levels between groups of children exposed to aircraft noise compared to those in a control group. Specifically, two studies analyzed cortisol and urinary catecholamine levels in school children as measurements of stress response to aircraft noise (Haines et al. 2001b, 2001c). In both instances, there were no differences between the aircraft-noise-exposed children and the control groups.

Other studies have reported hearing losses from exposure to aircraft noise. Noise-induced hearing loss was reportedly higher in children who attended a school located under a flight path near a Taiwan airport, as compared to children at another school far away (Chen et al. 1997). Another study reported that hearing ability was reduced significantly in individuals who lived near an airport and were frequently exposed to aircraft noise (Chen and Chen 1993). In that study, noise exposure near the airport was reportedly uniform, with DNL greater than 75 dB and maximum noise levels of about 87 dB during overflights. Conversely, several other studies that were reviewed reported no difference in hearing ability between children exposed to high levels of airport noise and children located in quieter areas (Andrus et al. 1975; Fisch 1977; Wu et al. 1995).

C.2.5 NOISE EFFECTS ON DOMESTIC ANIMALS AND WILDLIFE

Hearing is critical to an animal's ability to react, compete, reproduce, hunt, forage, and survive in its environment. While the existing literature does include studies on possible effects of jet aircraft noise and sonic booms on wildlife, there appears to have been little concerted effort in developing quantitative comparisons of aircraft noise effects on normal auditory characteristics. Behavioral effects have been relatively well described, but the larger ecological context issues, and the potential for drawing conclusions regarding effects on populations, has not been well developed.

The relationships between potential auditory/physiological effects and species interactions with their environments are not well understood. Manci et al. (1988) assert that the consequences that physiological effects may have on behavioral patterns are vital to understanding the long-term effects of noise on wildlife. Questions regarding the effects (if any) on predator-prey interactions, reproductive success, and intra-inter specific behavior patterns remain.

The following discussion provides an overview of the existing literature on noise effects (particularly jet aircraft noise) on animal species. The literature reviewed outlines those studies that have focused on the observations of the behavioral effects that jet aircraft and sonic booms have on animals.

A great deal of research was conducted in the 1960s and 1970s on the effects of aircraft noise on the public and the potential for adverse ecological impacts. These studies were largely completed in response to the increase in air travel and the introduction of supersonic jet aircraft. According to Manci et al. (1988), the foundation of information created from that focus does not necessarily correlate or provide information specific to the impacts on wildlife in areas overflown by aircraft at supersonic speed or at low altitudes.

The abilities to hear sounds and noise and to communicate assist wildlife in maintaining group cohesiveness and survivorship. Social species communicate by transmitting calls of warning, introduction, and others that are subsequently related to an individual's or group's responsiveness.

Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary. Primary effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or interfere with behavioral patterns (Manci et al. 1988). Although the effects are likely temporal, aircraft noise may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate and attract other members of their species. Aircraft noise may mask or interfere with these functions. Other primary effects, such as ear drum rupture or temporary (TTS) and permanent (PTS) hearing threshold shifts, are not as likely given the subsonic noise levels produced by aircraft overflights. Secondary effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Tertiary effects are the direct result of primary and secondary effects. These include population decline and habitat loss. Most of the effects of noise are mild enough to be undetectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region. Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci et al. 1988).

Many scientific studies have investigated the effects of aircraft noise on wildlife, and some have focused on wildlife "flight" due to noise. Apparently, animal responses to aircraft are influenced by many variables, including size, speed, proximity (both height above the ground and lateral distance), engine noise, color, flight profile, and radiated noise. The type of aircraft (e.g., fixed-wing versus rotor-wing [helicopter]) and type of flight mission may also produce different levels of disturbance, with varying animal responses (Manci et al. 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the 1988 Manci et al. literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the startle response. The intensity and duration of the startle response appear to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been previous exposures. Responses range from flight, trampling, stampeding, jumping, or running to movement of the head in the apparent direction of the noise source. Manci et al. (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

C.2.5.1 Domestic Animals

Although some studies report that the effects of aircraft noise on domestic animals is inconclusive, a majority of the literature reviewed indicates that domestic animals exhibit some behavioral responses to military overflights, but generally seem to habituate to the disturbances over a period of time. Mammals in particular appear to react to noise at sound levels higher than 90 dB, with responses including the startle response, freezing (i.e., becoming temporarily stationary), and fleeing from the sound source. Many studies on domestic animals suggest that some species appear to acclimate to some forms of sound disturbance (Manci et al. 1988). Some studies have reported primary and secondary effects, including reduced milk production and rate of milk release, increased glucose concentrations, decreased levels of hemoglobin, increased

heart rate, and a reduction in thyroid activity. These latter effects appear to represent a small percentage of the findings occurring in the existing literature.

Some reviewers have indicated that earlier studies and claims by farmers linking adverse effects of aircraft noise on livestock did not necessarily provide clear-cut evidence of cause and effect (Cottereau 1978). In contrast, many studies conclude that there is no evidence that aircraft overflights affect feed intake, growth, or production rates in domestic animals.

Cattle. In response to concerns about overflight effects on pregnant cattle, milk production, and cattle safety, the USAF prepared a handbook for environmental protection that summarizes the literature on the impacts of low-altitude flights on livestock (and poultry) and includes specific case studies conducted in numerous airspaces across the country. Adverse effects have been found in a few studies, but have not been reproduced in other similar studies. One such study, conducted in 1983, suggested that 2 of 10 cows in late pregnancy aborted after showing rising estrogen and falling progesterone levels. These increased hormonal levels were reported as being linked to 59 aircraft overflights. The remaining eight cows showed no changes in their blood concentrations and calved normally (USAF 1994). A similar study reported that abortions occurred in three out of five pregnant cattle after exposing them to flyovers by six different aircraft (USAF 1994). Another study suggested that feedlot cattle could stampede and injure themselves when exposed to low-level overflights (USAF 1994).

A majority of the studies reviewed suggest that there is little or no effect of aircraft noise on cattle. Studies presenting adverse effects on domestic animals have been limited. A number of studies (Kovalcik and Sottnik 1971; Parker and Bayley 1960) investigated the effects of jet aircraft noise and sonic booms on the milk production of dairy cows. Through the compilation and examination of milk production data from areas exposed to jet aircraft noise and sonic boom events, it was determined that milk yields were not affected. This was particularly evident in those cows that had been previously exposed to jet aircraft noise.

One study examined the causes of 1,763 abortions in Wisconsin dairy cattle over a 1-year time period, and none were associated with aircraft disturbances (USAF 1993). In 1987, Anderson contacted seven livestock operators for production data, and no effects of low-altitude and supersonic flights were noted. Three out of 43 cattle previously exposed to low-altitude flights showed a startle response to an F/A-18 aircraft flying overhead at 500 feet above ground level (AGL) at 400 knots by running less than 10 meters. They resumed normal activity within 1 minute (USAF 1994). In 1983, Beyer found that helicopters caused more reaction than other low-altitude overflights. A 1964 study also found that helicopters flying 30 to 60 feet overhead did not affect milk production and pregnancies of 44 cows and heifers (USAF 1994).

Additionally, Beyer reported that five pregnant dairy cows in a pasture did not exhibit fright-flight tendencies or have their pregnancies disrupted after being overflown by 79 low-altitude helicopter flights and 4 low-altitude, subsonic jet aircraft flights (USAF 1994). A 1956 study found that the reactions of dairy and beef cattle to noise from low-altitude, subsonic aircraft were similar to those caused by paper blowing about, strange persons, or other moving objects (USAF 1994).

In a report to Congress, the U.S. Forest Service concluded that “evidence both from field studies of wild ungulates and laboratory studies of domestic stock indicate that the risks of damage are small (from aircraft approaches of 50 to 100 meters), as animals take care not to damage themselves (USFS 1992). If animals are overflown by aircraft at altitudes of 50 to 100 meters, there is no evidence that mothers and young are separated, that animals collide with obstructions (unless confined) or that they traverse dangerous ground at too high a rate.” These varied study

results suggest that, although the confining of cattle could magnify animal response to aircraft overflight, there is no proven cause-and-effect link between startling cattle from aircraft overflights and abortion rates or lower milk production.

Horses. Horses have also been observed to react to overflights of jet aircraft. Several of the studies reviewed reported a varied response of horses to low-altitude aircraft overflights. Observations made in 1966 and 1968 noted that horses galloped in response to jet flyovers (USAF 1993). In 1995, Bowles cites Kruger and Erath as observing horses exhibiting intensive flight reactions, random movements, and biting/kicking behavior. However, no injuries or abortions occurred, and there was evidence that the mares adapted somewhat to the flyovers over the course of a month (USAF 1994). Although horses were observed noticing the overflights, it did not appear to affect either survivability or reproductive success. There was also some indication that habituation to these types of disturbances was occurring.

LeBlanc et al. studied the effects of F-14 jet aircraft noise on pregnant mares (1991). They specifically focused on any changes in pregnancy success, behavior, cardiac function, hormonal production, and rate of habituation. Their findings reported observations of "flight-fright" reactions, which caused increases in heart rates and serum cortisol concentrations. The mares, however, did habituate to the noise. Levels of anxiety and mass body movements were the highest after initial exposure, with intensities of responses decreasing thereafter. There were no differences in pregnancy success when compared to a control group.

Swine. Generally, the literature findings for swine appear to be similar to those reported for cows and horses. While there are some effects from aircraft noise reported in the literature, these effects are minor. Studies of continuous noise exposure (i.e., 6 hours or 72 hours of constant exposure) reported influences on short-term hormonal production and release. Additional constant exposure studies indicated the observation of stress reactions, hypertension, and electrolyte imbalances (Dufour 1980). A study by Bond et al. demonstrated no adverse effects on the feeding efficiency, weight gain, ear physiology, or thyroid and adrenal gland condition of pigs subjected to aircraft noise (1963). Observations of heart rate increase were recorded and it was noted that cessation of the noise resulted in the return to normal heart rates. Conception rates and offspring survivorship did not appear to be influenced by exposure to aircraft noise.

Similarly, simulated aircraft noise at levels of 100 dB to 135 dB had only minor effects on the rate of feed utilization, weight gain, food intake, and reproduction rates of boars and sows exposed, and there were no injuries or inner ear changes observed (Gladwin et al. 1988; Manci et al. 1988).

Domestic Fowl. According to a 1994 position paper by the USAF on effects of low-altitude overflights (below 1,000 feet) on domestic fowl, overflight activity has negligible effects (USAF 1994). The paper did recognize that given certain circumstances, adverse effects can be serious. Some of the effects can be panic reactions, reduced productivity, and effects on marketability (e.g., bruising of the meat caused during "pile-up" situations).

The typical reaction of domestic fowl after exposure to sudden, intense noise is a short-term startle response. The reaction ceases as soon as the stimulus is ended, and within a few minutes all activity returns to normal. More severe responses are possible depending on the number of birds, the frequency of exposure, and environmental conditions. Large crowds of birds and birds not previously exposed are more likely to pile up in response to a noise stimulus (USAF 1994). According to studies and interviews with growers, it is typically the previously unexposed birds that incite panic crowding, and the tendency to do so is markedly reduced within five exposures to the stimulus (USAF 1994). This suggests that the birds habituate relatively quickly. Egg

productivity was not adversely affected by infrequent noise bursts, even at exposure levels as high as 120 to 130 dB.

Between 1956 and 1988, there were 100 recorded claims against the Navy for alleged damage to domestic fowl. The number of claims averaged three per year, with peak numbers of claims following publications of studies on the topic in the early 1960s (USAF 1994). Many of the claims were disproved or did not have sufficient supporting evidence. The claims were filed for the following alleged damages: 55 percent for panic reactions, 31 percent for decreased production, 6 percent for reduced hatchability, 6 percent for weight loss, and less than 1 percent for reduced fertility (USAF 1994).

Turkeys. The review of the existing literature suggests that there has not been a concerted or widespread effort to study the effects of aircraft noise on commercial turkeys. One study involving turkeys examined the differences between simulated versus actual overflight aircraft noise, turkey responses to the noise, weight gain, and evidence of habituation (Bowles et al. 1990). Findings from the study suggested that turkeys habituated to jet aircraft noise quickly, that there were no growth rate differences between the experimental and control groups, and that there were some behavioral differences that increased the difficulty in handling individuals within the experimental group.

Low-altitude overflights were shown to cause turkey flocks that were kept inside turkey houses to occasionally pile up and experience high mortality rates due to the aircraft noise and a variety of disturbances unrelated to aircraft (USAF 1994).

C.2.5.2 Wildlife

Studies on the effects of overflights and sonic booms on wildlife have been focused mostly on avian species and ungulates such as caribou and bighorn sheep. Few studies have been conducted on marine mammals, small terrestrial mammals, reptiles, amphibians, and carnivorous mammals. Generally, species that live entirely below the surface of the water have also been ignored due to the fact they do not experience the same level of sound as terrestrial species (NPS 1994). Wild ungulates appear to be much more sensitive to noise disturbance than domestic livestock (Manci et al. 1988). This may be due to previous exposure to disturbances. One common factor appears to be that low-altitude flyovers seem to be more disruptive in terrain where there is little cover (Manci et al. 1988).

C.2.5.3 Mammals

Terrestrial Mammals. Studies of terrestrial mammals have shown that noise levels of 120 dBA can damage mammals' ears, and levels of 95 dBA can cause temporary loss of hearing acuity. Noise from aircraft has affected other large carnivores by causing changes in home ranges, foraging patterns, and breeding behavior. One study recommended that aircraft not be allowed to fly at altitudes below 2,000 feet AGL over important grizzly and polar bear habitat (Dufour 1980). Wolves have been frightened by low-altitude flights that were 25 to 1,000 feet off the ground. However, wolves have been found to adapt to aircraft overflights and noise as long as they were not being hunted from aircraft (Dufour 1980).

Wild ungulates (American bison, caribou, bighorn sheep) appear to be much more sensitive to noise disturbance than domestic livestock (Weisenberger et al. 1996). Behavioral reactions may be related to the past history of disturbances by such things as humans and aircraft. Common reactions of reindeer kept in an enclosure and exposed to aircraft noise disturbance were a slight startle response, raising of the head, pricking ears, and scenting of the air. Panic reactions and

extensive changes in behavior of individual animals were not observed. Observations of caribou in Alaska exposed to fixed-wing aircraft and helicopters showed running and panic reactions occurred when overflights were at an altitude of 200 feet or less. The reactions decreased with increased altitude of overflights, and for overflights higher than 500 feet in altitude, the panic reactions stopped. Also, smaller groups reacted less strongly than larger groups. One negative effect of the running and avoidance behavior is increased expenditure of energy. For a 90-kilogram animal, the calculated expenditure due to aircraft harassment is 64 kilocalories per minute when running and 20 kilocalories per minute when walking. When conditions are favorable, this expenditure can be counteracted with increased feeding; however, during harsh winter conditions, this may not be possible. Incidental observations of wolves and bears exposed to fixed-wing aircraft and helicopters suggested that wolves were less disturbed than wild ungulates, while grizzly bears showed the greatest response of any animal species observed.

It has been proven that low-altitude overflights do induce stress in animals. Increased heart rates, an indicator of excitement or stress, have been found in pronghorn antelope, elk, and bighorn sheep. These reactions occur naturally as a response to predation, so infrequent overflights may not, in and of themselves, be detrimental. However, flights at high frequencies over a long period of time may cause harmful effects. The consequences of this disturbance, while cumulative, are not additive. Aircraft disturbance may not cause obvious and serious health effects, but coupled with a harsh winter, it may have an adverse impact. Research has shown that stress induced by other types of disturbances produces long-term decreases in metabolism and hormone balances in wild ungulates.

Behavioral responses can range from mild to severe. Mild responses include head raising, body shifting, or turning to orient toward the aircraft. Moderate disturbance may be nervous behaviors, such as trotting a short distance. Escape is the typical severe response.

Marine Mammals. The physiological composition of the ear in aquatic and marine mammals exhibits adaptation to the aqueous environment. These differences (relative to terrestrial species) manifest themselves in the auricle and middle ear (Manci et al. 1988). Some mammals use echolocation to perceive objects in their surroundings and to determine the directions and locations of sound sources (Simmons 1983 in Manci et al. 1988).

Research conducted on northern fur seals, sea lions, and ringed seals indicated that there are some differences in how various animal groups receive frequencies of sound. It was observed that these species exhibited varying intensities of a startle response to airborne noise, which was habituated over time. The rates of habituation appeared to vary with species, populations, and demographics (age, sex). Time of day of exposure was also a factor (Muyberg 1978 in Manci et al. 1988).

Studies accomplished near the Channel Islands were conducted near the area where the space shuttle launches occur. It was found that there were some response differences between species relative to the loudness of sonic booms. Those booms that were between 80 and 89 dBA caused a greater intensity of startle reactions than lower-intensity booms of 72 to 79 dBA. However, the duration of the startle responses to louder sonic booms was shorter (Jehl and Cooper 1980 in Manci et al. 1988).

Jehl and Cooper indicated that low-flying helicopters, loud boat noises, and humans were the most disturbing to pinnipeds (1980). According to the research, although the space launch and associated operational activity noises have not had a measurable effect on the pinniped population, it also suggests that there was a greater “disturbance level” exhibited during launch activities. There was a recommendation to continue observations for behavioral effects and to perform long-term population monitoring (Jehl and Cooper 1980).

The continued presence of single or multiple noise sources could cause marine mammals to leave a preferred habitat. However, it does not appear likely that overflights could cause migration from suitable habitats because aircraft noise over water is mobile and would not persist over any particular area. Aircraft noise, including supersonic noise, currently occurs in the overwater airspace of Eglin, Tyndall, and Langley Air Force Bases from sorties predominantly involving jet aircraft. Survey results reported in Davis et al. indicate that cetaceans (i.e., dolphins) occur under all of the Eglin and Tyndall marine airspace (2000). The continuing presence of dolphins indicates that aircraft noise does not discourage use of the area and apparently does not harm the locally occurring population.

In a summary by the National Park Service on the effects of noise on marine mammals, it was determined that gray whales and harbor porpoises showed no outward behavioral response to aircraft noise or overflights (1994). Bottlenose dolphins showed no obvious reaction in a study involving helicopter overflights at 1,200 to 1,800 feet above the water. They also did not show any reaction to survey aircraft unless the shadow of the aircraft passed over them, at which point there was some observed tendency to dive (Richardson et al. 1995). Other anthropogenic noises in the marine environment from ships and pleasure craft may have more of an effect on marine mammals than aircraft noise (USAF 2000). The noise effects on cetaceans appear to be somewhat attenuated by the air/water interface.

Manatees appear relatively unresponsive to human-generated noise to the point that they are often suspected of being deaf to oncoming boats (although their hearing is actually similar to that of pinnipeds) (Bullock et al. 1980). Little is known about the importance of acoustic communication to manatees, although they are known to produce at least 10 different types of sounds and are thought to have sensitive hearing (Richardson et al. 1995).

C.2.5.4 Birds

Auditory research conducted on birds indicates that they fall between reptiles and mammals relative to hearing sensitivity. According to Dooling, within the range of 1,000 to 5,000 Hz, birds show a level of hearing sensitivity similar to that of the more sensitive mammals (1978). In contrast to mammals, bird sensitivity falls off at a greater rate with increasing and decreasing frequencies. Passive observations and studies examining aircraft bird strikes indicate that birds nest and forage near airports. Aircraft noise in the vicinity of commercial airports apparently does not inhibit bird presence and use.

High-noise events (like a low-altitude aircraft overflight) may cause birds to engage in escape or avoidance behaviors, such as flushing from perches or nests (Ellis et al. 1991). These activities impose an energy cost on the birds that, over the long term, may affect survival or growth. In addition, the birds may spend less time engaged in necessary activities like feeding, preening, or caring for their young because they spend time in noise-avoidance activity. However, the long-term significance of noise-related impacts is less clear. Several studies on nesting raptors have indicated that birds become habituated to aircraft overflights and that long-term reproductive success is not affected (Grubb and King 1991; Ellis et al. 1991). Threshold noise levels for significant responses range from 62 dB for Pacific black brant to 85 dB for crested tern (Brown 1990; Ward and Stehn 1990).

Songbirds were observed to become silent prior to the onset of a sonic boom event (F-111 jets), followed by “raucous discordant cries.” There was a return to normal singing within 10 seconds after the boom (Higgins 1974 in Manci et al. 1988). Ravens responded by emitting protestation calls, flapping their wings, and soaring.

Manci et al. reported a reduction in reproductive success in some small territorial passerines (i.e., perching birds or songbirds) after exposure to low-altitude overflights (1988). However, it has been observed that passerines are not driven any great distance from a favored food source by a nonspecific disturbance, such as aircraft overflights (USFS 1992). Further study may be warranted.

A recent study, conducted cooperatively between DoD and the U.S. Fish and Wildlife Service, assessed the response of the red-cockaded woodpecker to a range of military training noise events, including artillery, small arms, helicopter, and maneuver noise (Pater et al. 1999). The project findings show that the red-cockaded woodpecker successfully acclimates to military noise events. Depending on the noise level, which ranged from innocuous to very loud, the birds responded by flushing from their nest cavities. When the noise source was closer and the noise level was higher, the number of flushes increased proportionately. In all cases, however, the birds returned to their nests within a relatively short period of time (usually within 12 minutes). Additionally, the noise exposure did not result in any mortality or statistically detectable changes in reproductive success (Pater et al. 1999). Red-cockaded woodpeckers did not flush when artillery simulators were more than 122 meters away and SEL noise levels were 70 dBA.

Lynch and Speake studied the effects of both real and simulated sonic booms on the nesting and brooding eastern wild turkey in Alabama (1978). Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick lifting of the head and apparent alertness for between 10 and 20 seconds. No apparent nest failure occurred as a result of the sonic booms.

Twenty-one brood groups were also subjected to simulated sonic booms. Reactions varied slightly between groups, but the largest percentage of groups reacted by standing motionless after the initial blast. Upon the sound of the boom, the hens and poults fled until reaching the edge of the woods (approximately 4 to 8 meters). Afterward, the poults resumed feeding activities while the hens remained alert for a short period of time (approximately 15 to 20 seconds). In no instances were poults abandoned, nor did they scatter and become lost. Every observation group returned to normal activities within a maximum of 30 seconds after a blast.

C.2.5.4.1 Raptors

In a literature review of raptor responses to aircraft noise, Manci et al. found that most raptors did not show a negative response to overflights (1988). When negative responses were observed, they were predominantly associated with rotor-winged aircraft or jet aircraft that were repeatedly passing within 0.5 miles of a nest.

Ellis et al. performed a study to estimate the effects of low-level military jet aircraft and mid-to high-altitude sonic booms (both actual and simulated) on nesting peregrine falcons and seven other raptors (common black-hawk, Harris' hawk, zone-tailed hawk, red-tailed hawk, golden eagle, prairie falcon, bald eagle) (1991). They observed responses to test stimuli, determined nest success for the year of the testing, and evaluated site occupancy the following year. Both long- and short-term effects were noted in the study. The results reported the successful fledging of young in 34 of 38 nest sites (all eight species) subjected to low-level flight and/or simulated sonic booms. Twenty-two of the test sites were revisited in the following year, and observations of pairs or lone birds were made at all but one nest. Nesting attempts were underway at 19 of 20 sites that were observed long enough to be certain of breeding activity. Re-occupancy and productivity rates were within or above expected values for self-sustaining populations.

Short-term behavior responses were also noted. Overflights at a distance of 150 meters or less produced few significant responses and no severe responses. Typical responses included

crouching or, very rarely, flushing from the perch site. Significant responses were most evident before egg laying and after young were "well grown." Incubating or brooding adults never burst from the nest, thus preventing egg breaking or knocking chicks out of the nest. Jet passes and sonic booms often caused noticeable alarm; however, significant negative responses were rare and did not appear to limit productivity or re-occupancy. The locations of some of the nests may have caused some birds to be habituated to aircraft noise. There were some test sites located at distances far from zones of frequent military aircraft usage, and the test stimuli were often closer, louder, and more frequent than would be likely for a normal training situation.

Manci et al. noted that a female northern harrier was observed hunting on a bombing range in Mississippi during bombing exercises (1988). The harrier was apparently unfazed by the exercises, even when a bomb exploded within 200 feet. In a similar case of habituation/non-disturbance, a study on the Florida snail-kite stated that the greatest reaction to overflights (approximately 98 dBA) was "watching the aircraft fly by." No detrimental impacts to distribution, breeding success, or behavior were noted.

Bald Eagle. A study by Grubb and King on the reactions of the bald eagle to human disturbances showed that terrestrial disturbances elicited the greatest response, followed by aquatic (i.e., boats) and aerial disturbances (1991). The disturbance regime of the area where the study occurred was predominantly characterized by aircraft noise. The study found that pedestrians consistently caused responses that were greater in both frequency and duration. Helicopters elicited the highest level of aircraft-related responses. Aircraft disturbances, although the most common form of disturbance, resulted in the lowest levels of response. This low response level may have been due to habituation; however, flights less than 170 meters away caused reactions similar to other disturbance types. Ellis et al. showed that eagles typically respond to the proximity of a disturbance, such as a pedestrian or aircraft within 100 meters, rather than the noise level (1991). They also noted that helicopters were four times more likely to cause a reaction than a commercial jet and 20 times more likely to cause a reaction than a propeller plane. Fraser et al. have suggested that raptors habituate to overflights rapidly, sometimes tolerating aircraft approaches of 65 feet or less (1985).

Osprey. A 1998 study by Trimper et al. in Goose Bay, Labrador, Canada, focused on the reactions of nesting osprey to military overflights by CF-18 Hornets. Reactions varied from increased alertness and focused observation of planes to adjustments in incubation posture. No overt reactions (e.g., startle response, rapid nest departure) were observed as a result of an overflight. Young nestlings crouched as a result of any disturbance until they grew to 1 to 2 weeks prior to fledging. Helicopters, human presence, float planes, and other ospreys elicited the strongest reactions from nesting ospreys. These responses included flushing, agitation, and aggressive displays. Adult osprey showed high nest occupancy rates during incubation regardless of external influences.

The osprey observed occasionally stared in the direction of the flight before it was audible to the observers. The birds may have been habituated to the noise of the flights; however, overflights were strictly controlled during the experimental period. Strong reactions to float planes and helicopter may have been due to the slower flight and therefore longer duration of visual stimuli rather than noise-related stimuli.

Red-Tailed Hawk. Andersen et al. conducted a study that investigated the effects of low-level helicopter overflights on 35 red-tailed hawk nests (1989). Some of the nests had not been flown over prior to the study. The hawks that were naïve (i.e., not previously exposed) to helicopter flights exhibited stronger avoidance behavior (9 of 17 birds flushed from their nests) than those

that had experienced prior overflights. The overflights did not appear to affect nesting success in either study group. These findings were consistent with the belief that red-tailed hawks habituate to low-level air traffic, even during the nesting period.

C.2.5.4.2 Migratory Waterfowl

A study by Conomy et al. exposed previously unexposed ducks to 71 noise events per day that equaled or exceeded 80 dBA (1998). It was determined that the proportion of time black ducks reacted to aircraft activity and noise decreased from 38 percent to 6 percent in 17 days and remained stable at 5.8 percent thereafter. In the same study, the wood duck did not appear to habituate to aircraft disturbance. This supports the notion that animal response to aircraft noise is species-specific. Because a startle response to aircraft noise can result in flushing from nests, migrants and animals living in areas with high concentrations of predators would be the most vulnerable to experiencing effects of lowered birth rates and recruitment over time. Species that are subjected to infrequent overflights do not appear to habituate to overflight disturbance as readily.

Black brant studied in the Alaskan Peninsula were exposed to jets and propeller aircraft, helicopters, gunshots, people, boats, and various raptors. Jets accounted for 65 percent of all the disturbances. Humans, eagles, and boats caused a greater percentage of brant to take flight. There was markedly greater reaction to Bell-206-B helicopter flights than fixed-wing, single-engine aircraft (Ward et al. 1986).

The presence of humans and low-flying helicopters in the Mackenzie Valley North Slope area did not appear to affect the population density of Lapland longspurs, but the experimental group was shown to have reduced hatching and fledging success and higher nest abandonment. Human presence appeared to have a greater impact on the incubating behavior of the black brant, common eider, and Arctic tern than fixed-wing aircraft (Gunn and Livingston 1974).

Gunn and Livingston found that waterfowl and seabirds in the Mackenzie Valley and North Slope of Alaska and Canada became acclimated to float plane disturbance over the course of 3 days (1974). Additionally, it was observed that potential predators (bald eagle) caused a number of birds to leave their nests. Non-breeding birds were observed to be more reactive than breeding birds. Waterfowl were affected by helicopter flights, while snow geese were disturbed by Cessna 185 flights. The geese flushed when the planes were under 1,000 feet, compared to higher flight elevations. An overall reduction in flock sizes was observed. It was recommended that aircraft flights be reduced in the vicinity of pre-migratory staging areas.

Manci et al. reported that waterfowl were particularly disturbed by aircraft noise (1988). The most sensitive appeared to be snow geese. Canada geese and snow geese were thought to be more sensitive than other animals such as turkey vultures, coyotes, and raptors (Edwards et al. 1979).

C.2.5.4.3 Wading and Shore Birds

Black et al. studied the effects of low-altitude (less than 500 feet AGL) military training flights with sound levels from 55 to 100 dBA on wading bird colonies (i.e., great egret, snowy egret, tricolored heron, and little blue heron) (1984). The training flights involved three or four aircraft, which occurred once or twice per day. This study concluded that the reproductive activity—including nest success, nestling survival, and nestling chronology—was independent of F-16 overflights. Dependent variables were more strongly related to ecological factors, including location and physical characteristics of the colony and climatology. Another study on the effects of circling fixed-wing aircraft and helicopter overflights on wading bird colonies found that at altitudes of 195 to 390 feet, there was no reaction in nearly 75 percent of the 220 observations.

Ninety percent displayed no reaction or merely looked toward the direction of the noise source. Another 6 percent stood up, 3 percent walked from the nest, and 2 percent flushed (but were without active nests) and returned within 5 minutes (Kushlan 1979). Apparently non-nesting wading birds had a slightly higher incidence of reacting to overflights than nesting birds. Seagulls observed roosting near a colony of wading birds in another study remained at their roosts when subsonic aircraft flew overhead (Burger 1981). Colony distribution appeared to be most directly correlated to available wetland community types and was found to be distributed randomly with respect to Military Training Routes. These results suggest that wading bird species presence was most closely linked to habitat availability and that they were not affected by low-level military overflights (USAF 2000).

Burger studied the response of migrating shorebirds to human disturbance and found that shorebirds did not fly in response to aircraft overflights, but did flush in response to more localized intrusions (i.e., humans and dogs on the beach) (1986). Burger studied the effects of noise from John F. Kennedy International Airport in New York on herring gulls that nested less than 1 kilometer from the airport (1981). Noise levels over the nesting colony were 85 to 100 dBA on approach and 94 to 105 dBA on takeoff. Generally, there did not appear to be any prominent adverse effects of subsonic aircraft on nesting, although some birds flushed when a Concorde flew overhead and, when they returned, engaged in aggressive behavior. Groups of gulls tended to loaf in the area of the nesting colony, and these birds remained at the roost when the Concorde flew overhead. Up to 208 of the loafing gulls flew when supersonic aircraft flew overhead. These birds would circle around and immediately land in the loafing flock (USAF 2000).

In 1970, sonic booms were potentially linked to a mass hatch failure of sooty terns on the Dry Tortugas (Austin et al. 1970). The cause of the failure was not certain, but it was conjectured that sonic booms from military aircraft or an overgrowth of vegetation were factors. In the previous season, sooties were observed to react to sonic booms by rising in a “panic flight,” circling over the island, and then usually settling down on their eggs again. Hatching that year was normal. Following the 1969 hatch failure, excess vegetation was cleared and measures were taken to reduce supersonic activity. The 1970 hatch appeared to proceed normally. A colony of noddies on the same island hatched successfully in 1969, the year of the sooty hatch failure.

Subsequent laboratory tests of exposure of eggs to sonic booms and other impulsive noises (Bowles et al. 1991; Bowles et al. 1994; Cogger and Zegarra 1980) failed to show adverse effects on the hatching of eggs. A structural analysis (Ting et al. 2002) showed that, even under extraordinary circumstances, sonic booms would not damage an avian egg.

Burger observed no effects of subsonic aircraft on herring gulls in the vicinity of John F. Kennedy International Airport (1981). The Concorde aircraft did cause more nesting gulls to leave their nests (especially in areas of higher density of nests), causing the breakage of eggs and the scavenging of eggs by intruder prey. Clutch sizes were observed to be smaller in areas of higher-density nesting (presumably due to the greater tendency for panic flight) than in areas where there were fewer nests.

C.2.5.5 Fish, Reptiles, and Amphibians

The effects of overflight noise on fish, reptiles, and amphibians have been poorly studied, but conclusions regarding their expected responses have involved speculation based upon known physiologies and behavioral traits of these taxa (Gladwin et al. 1988). Although fish do startle in response to low-flying aircraft noise, and probably to the shadows of aircraft, they have been found to habituate to the sound and overflights. Reptiles and amphibians that respond to low frequencies and those that respond to ground vibration, such as spadefoots (genus *Scaphiopus*),

may be affected by noise. Limited information is available on the effects of short-duration noise events on reptiles. Dufour in 1980 and Manci et al. in 1988, summarized a few studies of reptile responses to noise. Some reptile species tested under laboratory conditions experienced at least TTSs or hearing loss after exposure to 95 dB for several minutes. Crocodilians in general have the most highly developed hearing of all reptiles. Crocodile ears have lids that can be closed when the animal goes under water. These lids can reduce the noise intensity by 10 to 12 dB (Wever and Vernon 1957). On Homestead Air Reserve Station, Florida, two crocodilians (the American alligator and the spectacled caiman) reside in wetlands and canals along the base runway, suggesting that they can coexist with existing noise levels of an active runway, including DNLs of 85 dB.

C.2.5.6 Summary

Some physiological/behavioral responses such as increased hormonal production, increased heart rate, and reduction in milk production have been described in a small percentage of studies. A majority of the studies focusing on these types of effects have reported short-term or no effects.

The relationships between physiological effects and how species interact with their environments have not been thoroughly studied. Therefore, the larger ecological context issues regarding physiological effects of jet aircraft noise (if any) and resulting behavioral pattern changes are not well understood.

Animal species exhibit a wide variety of responses to noise. It is therefore difficult to generalize animal responses to noise disturbances or to draw inferences across species, as reactions to jet aircraft noise appear to be species-specific. Consequently, some animal species may be more sensitive than other species and/or may exhibit different forms or intensities of behavioral responses. For instance, one study suggests that wood ducks appear to be more sensitive and more resistant to acclimation to jet aircraft noise than Canada geese. Similarly, wild ungulates seem to be more easily disturbed than domestic animals.

The literature does suggest that common responses include the “startle” or “fright” response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise and sonic booms.

Animal responses to aircraft noise appear to be somewhat dependent on, or influenced by, the size, shape, speed, proximity (vertical and horizontal), engine noise, color, and flight profile of planes. Helicopters also appear to induce greater intensities and durations of disturbance behavior as compared to fixed-wing aircraft. Some studies showed that animals that had been previously exposed to jet aircraft noise exhibited greater degrees of alarm and disturbance to other objects creating noise, such as boats, people, and objects blowing across the landscape. Other factors influencing response to jet aircraft noise may include wind direction, speed, and local air turbulence; landscape structures (i.e., amount and type of vegetative cover); and, in the case of bird species, whether the animals are in the incubation/nesting phase.

C.2.6 PROPERTY VALUES

There are a number of factors that affect property values, which makes predicting impacts difficult. Factors directly related to the property, such as size, improvements, and location of the property, as well as current conditions in the real estate market, interest rates, and housing sales

in the area, are more likely to have a direct adverse impact on property values. Several studies have analyzed property values as they relate to military and civilian aircraft noise. In one study, a regression analysis of property values as they relate to aircraft noise at two military installations was conducted (Fidell et al. 1996). This study found that, while aircraft noise at these installations may have had minor impacts on property values, it was difficult to quantify that impact. Other factors, such as the quality of the housing near the installations and the local real estate market, had a larger impact on property values. Therefore, the regression analysis was not able to predict the impact of aircraft noise on the property values of two comparable properties.

Another study analyzed 33 other studies attempting to quantify the impact of noise on property values (Nelson 2003). The result of the study supports the idea that the potential for an adverse impact on property values as a result of aircraft noise exists and estimates that the value of a specific property could be discounted between 0.5 and 0.6 percent per decibel when compared to a similar property that is not impacted by aircraft noise. Additional data indicate that the discount for property values as a result of noise would be higher for noise levels above 75 dB DNL.

C.2.7 SUBSONIC AIRCRAFT NOISE EFFECTS ON STRUCTURES

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of the excitation of structural component resonance. While certain frequencies (such as 30 Hz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than 1 second above a sound level of 130 dB are potentially damaging to structural components (CHABA 1977). A study directed specifically at low-altitude, high-speed aircraft showed that there is little probability of structural damage from such operations (Sutherland 1989). One finding in that study is that sound levels at damaging frequencies (e.g., 30 Hz for window breakage or 15 to 25 Hz for whole-house response) are rarely above 130 dB.

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or “rattle,” of objects within the dwelling, such as hanging pictures, dishes, plaques, and bric-a-brac. Window panes may also vibrate noticeably when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally incompatible with residential land use. Thus, assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

C.2.8 SUBSONIC AIRCRAFT NOISE EFFECTS ON STRUCTURE AND TERRAIN

Members of the public often believe that noise from low-flying aircraft can cause avalanches or landslides by disturbing fragile soil or snow structures in mountainous areas. There are no known instances of such effects, and it is considered improbable that such effects would result from routine, subsonic aircraft operations.

C.2.9 NOISE EFFECTS ON HISTORICAL AND ARCHAEOLOGICAL SITES

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. Most scientific studies of the effects of noise and vibration on historic properties have considered potential impacts on standing architecture. For example, the FAA published a study

of potential impacts resulting from vibrations caused by the noise of subsonic Concorde overflights on five historic properties, including a restored plantation house, a stone bridge and tollhouse, and other structures (Hershey, Kevala, and Burns 1975). This study analyzed the breakage probabilities of structural elements that might be considered susceptible to vibration, such as window glass, mortar, and plaster. The results indicated that, with the exception of some already cracked window glass, there was no practical risk of noise-induced vibration damage to any of these structures.

Some studies of the effects of overflights—both subsonic and supersonic—on archaeological structures and other types of sites also have been published. Battis examined the effects of low-altitude overflights of B-52, RF-4C, and A-7 aircraft on standing walls at Long House Ruin in northeastern Arizona (Battis 1988). The motion levels observed during all passes were well below a conservative threshold for vibration in ancient structures, a level of 1.3 millimeters per second, established by two previous studies. Battis concluded that vibration associated with aircraft overflights at speeds and altitudes similar to those measured in his study would have no significant damaging effect on Long House and similar sites.

USAF National Environment Policy Act documents have examined the potential impacts on historic properties that might result from subsonic and supersonic overflights. In 1995, USAF published the *Environmental Assessment for Continued Supersonic Operations in the Black Mountain Supersonic Corridor and the Alpha/Precision Impact Range Area*. Eligible and potentially eligible cultural resources in the area of potential effect include petroglyph and pictograph panels located on a variety of rock types, historic adobe and non-adobe structures with standing walls, and historic mines (which contain tunnels) and wells. The report concludes that supersonic low-altitude flights have occurred over these corridors for 25 years or more and have resulted in no significant impacts on cultural resources. The California State Historic Preservation Office agreed, and during National Historic Preservation Act (NHPA) Section 106 review of this undertaking, concurred with USAF's finding that continued supersonic overflights would have no effect on historic properties.

As noted above for the noise effects of noise-induced vibrations on normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

C.3 SUBSONIC AIRCRAFT NOISE MODELING

An aircraft in subsonic flight generally emits noise from two sources: the engines and flow noise around the airframe. Noise generation mechanisms are complex and, in practical models, the noise sources must be based on measured data. The USAF has developed a series of computer models and aircraft noise databases for this purpose. The models include NOISEMAP (Moulton 1992), which is used to model noise around airbases. This model uses the NOISEFILE database developed by USAF. NOISEFILE data include SEL and L_{max} as a function of speed and power setting for aircraft in straight flight.

Noise from an individual aircraft is a time-varying continuous sound. It is first audible as the aircraft approaches, increases to a maximum when the aircraft is near its closest point, then diminishes as it departs. The noise depends on the speed and power setting of the aircraft and its trajectory. The models noted above divide the trajectory into segments whose noise can be computed from the data in NOISEFILE. The contributions from these segments are summed.

Supporting routines from NOISEMAP were used to calculate SEL and L_{max} for various flight altitudes and lateral off-sets from a ground receiver position. Sound intensity at a point on the

ground is also affected by several environmental factors, such as atmospheric conditions and properties of the terrain being overflown.

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ATTACHMENT C-1 REPRESENTATIVE LOCATIONS POINT ANALYSIS

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Attachment C-1. Representative Locations Point Analysis

As part of the noise analysis, a detailed acoustical analysis was performed for a series of locations, which are listed in Tables C-1-1 through C-1-4. As described in Appendix B, Section B.1, these points were established based on central points of U.S. Census subdivisions, and therefore, do not represent a specific noise-sensitive receptor.

Tables C-1-1 through C-1-4 present the details of the major noise contributors at each basing alternative under baseline and proposed scenarios. For example, under the Altus AFB baseline scenario, the contributor of the highest SEL to Location No. 1 is C-17 flying profile C17VPE, which is a closed pattern. At the point of maximum noise level, the aircraft is located at a slant distance of 254 feet, at a height of 1,460 feet above mean sea level (MSL), a power setting of 1.4 EPR, and a speed of 180 knots. The event would be expected to occur approximately 2.27 times per training day between the hours of 7:00 A.M. and 10:00 P.M., and the SEL for that event is approximately 106.9 dB.

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios

Altus Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
1	1	C-17	C17VPE	PAT	17RC44	1.14 EPR	180	1,460	254	2.27	0.24	106.9
1	2	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	2,180	987	7.86	0.77	100.9
1	3	C-17	C17A16	ARR	17LA32	1.14 EPR	160	1,810	669	0.18	0.01	99.6
1	4	C-17	C17VPK	PAT	17LC44	1.14 EPR	180	2,173	825	0.63	0.00	96.5
1	5	C-17	C17IPE	PAT	17LC14	1.14 EPR	160	1,784	851	1.56	0.09	96.4
1	6	C-17	C17A15	ARR	17LA32	1.14 EPR	180	1,832	937	0.18	0.01	96.3
1	7	C-17	C17A8	ARR	17AA33	1.15 EPR	160	1,805	821	4.28	0.27	96.0
1	8	C-17	C17DD	DEP	35RD11	1.34 EPR	160	2,804	1,734	0.89	0.00	95.9
1	9	C-17	C17VPL	PAT	17LC45	1.14 EPR	180	2,120	862	0.12	0.00	95.9
1	10	C-17	C17A15	ARR	17LA32	1.14 EPR	180	2,244	888	0.18	0.01	95.6
2	1	C-17	C17A46	ARR	35RA32	1.10 EPR	200	2,000	736	0.10	0.00	97.1
2	2	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,651	2,395	14.61	1.42	92.3
2	3	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,651	2,395	12.62	0.59	92.3
2	4	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,651	2,395	3.91	0.26	92.3
2	5	KC-46X	46RCX	PAT	35RC13	60.00 % N1	180	1,702	476	1.21	0.14	91.4
2	6	C-17	C17VPP	PAT	35RC13	1.20 EPR	160	2,900	1,604	6.79	0.32	90.7
2	7	C-17	C17VPO	PAT	35LC17	1.20 EPR	160	2,900	1,603	1.23	0.06	90.6
2	8	KC-135R	135RDC	DEP	17LD32	92.00 % NF	185	2,841	1,904	0.19	0.03	88.8
2	9	C-17	C17TDB	DEP	17LD32	1.34 EPR	250	4,506	3,394	1.03	0.00	88.5
2	10	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	4,949	3,798	0.46	0.00	88.2
3	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	250	2,915	1,499	0.24	0.00	101.5
3	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	250	2,915	1,499	0.24	0.00	101.5
3	3	C-17	C17A18	ARR	17RA21	1.15 EPR	125	2,066	685	0.08	0.06	99.4
3	4	C-17	C17A19	ARR	17RA22	1.14 EPR	125	2,096	712	0.08	0.06	98.9
3	5	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	2,135	749	0.78	0.05	98.5
3	6	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	2,135	749	0.78	0.05	98.5
3	7	C-17	TC17A1	ARR	17RA11	1.14 EPR	140	2,119	733	0.09	0.03	98.3
3	8	C-17	C17AB	ARR	17RA11	1.14 EPR	140	2,119	733	1.25	0.00	98.3
3	9	C-17	C17VPI	PAT	17LC17	1.10 EPR	160	2,018	710	3.91	0.26	98.2
3	10	C-17	C17VPA	PAT	17RC13	1.10 EPR	160	2,020	711	0.44	0.03	98.2
4	1	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,034	945	14.61	1.42	102.1
4	2	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,034	945	12.62	0.59	102.1
4	3	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,034	945	3.91	0.26	102.1
4	4	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	2,537	1,658	1.03	0.00	97.4
4	5	C-17	C17TDA	DEP	17LD31	1.42 EPR	250	2,262	1,654	1.03	0.00	96.6
4	6	C-17	C17DA	DEP	17LD11	1.34 EPR	160	2,457	1,751	1.64	0.00	96.2
4	7	C-17	C17VPK	PAT	17LC44	1.34 EPR	170	2,726	1,781	0.63	0.00	96.1
4	8	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	2,726	1,781	0.46	0.00	96.1
4	9	C-17	C17VPL	PAT	17LC45	1.34 EPR	170	2,726	1,781	0.12	0.00	96.1
4	10	C-17	C17A42	ARR	35RA33	1.15 EPR	160	991	971	1.46	0.05	95.9
5	1	C-17	C17VPO	PAT	35LC17	1.34 EPR	170	2,255	996	1.23	0.06	101.2
5	2	C-17	C17VPM	PAT	35LC13	1.34 EPR	170	2,360	1,088	0.23	0.02	100.5
5	3	C-17	C17VPN	PAT	35LC16	1.34 EPR	170	2,360	1,088	0.87	0.09	100.5

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
5	4	C-17	C17TDH	DEP	35RD32	1.34 EPR	160	2,382	1,632	0.55	0.00	98.3
5	5	C-17	C17VPP	PAT	35RC13	1.34 EPR	170	1,943	1,517	6.79	0.32	98.0
5	6	C-17	C17TDG	DEP	35RD31	1.42 EPR	250	1,882	1,656	0.55	0.00	96.6
5	7	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	1,884	1,655	7.86	0.77	96.5
5	8	C-17	C17VPX	PAT	35RC42	1.34 EPR	170	2,530	1,742	0.25	0.00	96.5
5	9	C-17	C17VPW	PAT	35RC44	1.34 EPR	170	2,530	1,742	0.34	0.00	96.5
5	10	C-17	C17VPT	PAT	35RC45	1.34 EPR	170	2,530	1,742	0.07	0.00	96.5
6	1	C-17	C17A46	ARR	35RA32	1.10 EPR	200	2,000	727	0.10	0.00	96.7
6	2	C-17	C17IPE	PAT	17LC14	1.20 EPR	160	1,982	1,454	1.56	0.09	92.8
6	3	C-17	C17VPH	PAT	17LC16	1.10 EPR	160	2,899	1,594	14.61	1.42	91.8
6	4	C-17	C17VPG	PAT	17LC13	1.10 EPR	160	2,899	1,594	12.62	0.59	91.8
6	5	C-17	C17VPI	PAT	17LC17	1.10 EPR	160	2,899	1,594	3.91	0.26	91.7
6	6	C-17	C17VPO	PAT	35LC17	1.20 EPR	160	2,900	1,594	1.23	0.06	91.0
6	7	C-17	C17VPP	PAT	35RC13	1.20 EPR	160	2,900	1,594	6.79	0.32	91.0
6	8	C-17	C17VPU	PAT	35RC16	1.20 EPR	160	2,898	1,592	7.86	0.77	90.8
6	9	C-17	C17VPN	PAT	35LC16	1.20 EPR	160	2,899	1,593	0.87	0.09	90.8
6	10	C-17	C17A32	ARR	35AA32	1.10 EPR	200	2,000	1,649	0.15	0.01	87.9
7	1	C-17	C17TDH	DEP	35RD32	1.40 EPR	0	1,382	1,609	0.55	0.00	101.4
7	2	C-17	C17TDG	DEP	35RD31	1.40 EPR	0	1,382	1,609	0.55	0.00	101.3
7	3	C-17	C17TDB	DEP	17LD32	1.42 EPR	145	1,751	1,660	1.03	0.00	98.7
7	4	C-17	C17TDA	DEP	17LD31	1.42 EPR	145	1,530	1,620	1.03	0.00	97.9
7	5	KC-135R	135RDL	DEP	35RD32	88.00 % NF	0	1,382	1,609	0.13	0.02	97.5
7	6	KC-135R	135RDK	DEP	35RD12	88.00 % NF	0	1,382	1,609	0.00	0.00	97.5
7	7	KC-135R	135RDJ	DEP	35RD11	88.00 % NF	0	1,382	1,609	0.01	0.00	97.5
7	8	C-17	C17DA	DEP	17LD11	1.34 EPR	130	1,751	1,660	1.64	0.00	97.1
7	9	C-17	C17VPK	PAT	17LC44	1.34 EPR	140	1,636	1,635	0.63	0.00	96.8
7	10	C-17	C17VPJ	PAT	17LC42	1.34 EPR	140	1,636	1,635	0.46	0.00	96.8
8	1	C-17	C17IPF	PAT	35RC14	1.14 EPR	160	1,899	1,063	0.84	0.05	94.0
8	2	C-17	C17VPQ	PAT	35LC42	1.14 EPR	180	2,295	1,174	0.88	0.09	93.1
8	3	KC-135R	135RDC	DEP	17LD32	92.00 % NF	185	2,572	1,361	0.19	0.03	92.6
8	4	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	3,892	2,656	1.03	0.00	91.0
8	5	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	4,254	2,996	0.46	0.00	90.3
8	6	C-17	C17VPK	PAT	17LC44	1.34 EPR	170	4,254	2,996	0.63	0.00	90.3
8	7	C-17	C17VPL	PAT	17LC45	1.34 EPR	170	4,254	2,996	0.12	0.00	90.3
8	8	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,479	2,989	14.61	1.42	90.2
8	9	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,479	2,989	12.62	0.59	90.2
8	10	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,479	2,989	3.91	0.26	90.2
9	1	T-38C	T38C2	PAT	17RC12	100.00 % RPM	250	2,513	1,182	0.45	0.00	104.1
9	2	T-38C	T38C1	PAT	17RC11	100.00 % RPM	250	2,513	1,182	0.45	0.00	104.1
9	3	C-17	C17A40	ARR	35LA32	1.14 EPR	160	1,722	406	0.30	0.21	104.0
9	4	C-17	C17A36	ARR	35LA34	1.14 EPR	160	1,721	406	0.30	0.21	103.9

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
9	5	C-17	C17A39	ARR	35LA23	1.15 EPR	125	1,769	451	0.04	0.03	103.1
9	6	C-17	C17A38	ARR	35LA22	1.15 EPR	125	1,769	451	0.04	0.03	103.1
9	7	C-17	C17A37	ARR	35LA21	1.15 EPR	125	1,769	451	0.04	0.03	103.1
9	8	C-17	C17IPC	PAT	35LC11	1.14 EPR	140	1,786	467	0.42	0.03	102.9
9	9	C-17	C17IPD	PAT	35LC12	1.14 EPR	140	1,786	467	0.42	0.03	102.9
9	10	C-17	C17VPV	PAT	35RC17	1.10 EPR	140	1,744	423	2.11	0.14	102.9
10	1	T-38C	T38C1	PAT	17RC11	100.00 % RPM	250	2,686	1,627	0.45	0.00	100.5
10	2	T-38C	T38C2	PAT	17RC12	100.00 % RPM	250	2,686	1,627	0.45	0.00	100.5
10	3	C-17	C17VPV	PAT	35RC17	1.10 EPR	140	1,875	798	2.11	0.14	97.0
10	4	C-17	TC17D2	DEP	17RD12	1.34 EPR	160	2,863	1,777	0.06	0.00	95.7
10	5	C-17	TC17D1	DEP	17RD11	1.34 EPR	160	2,863	1,777	0.06	0.00	95.7
10	6	C-17	C17DB	DEP	17RD11	1.34 EPR	160	2,863	1,777	3.44	0.28	95.7
10	7	C-17	C17A40	ARR	35LA32	1.14 EPR	160	1,848	1,053	0.30	0.21	95.2
10	8	T-38C	T38D1	DEP	17RD11	100.00 % RPM	250	3,702	2,544	0.36	0.00	95.0
10	9	T-38C	T38D2	DEP	17RD12	100.00 % RPM	250	3,702	2,544	0.36	0.00	95.0
10	10	C-17	C17A36	ARR	35LA34	1.14 EPR	160	1,846	1,052	0.30	0.21	94.8
11	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	250	2,561	1,201	0.24	0.00	103.9
11	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	250	2,561	1,201	0.24	0.00	103.9
11	3	C-17	C17A24	ARR	17RA32	1.14 EPR	160	1,785	497	0.55	0.39	102.2
11	4	C-17	C17A35	ARR	17RA34	1.14 EPR	160	1,785	497	0.55	0.39	102.0
11	5	C-17	C17A18	ARR	17RA21	1.15 EPR	125	1,804	512	0.08	0.06	101.8
11	6	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	1,845	544	0.78	0.05	101.5
11	7	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	1,845	544	0.78	0.05	101.5
11	8	C-17	C17VPI	PAT	17LC17	1.10 EPR	140	1,777	490	3.91	0.26	101.4
11	9	C-17	C17A19	ARR	17RA22	1.14 EPR	125	1,822	526	0.08	0.06	101.4
11	10	C-17	C17VPA	PAT	17RC13	1.10 EPR	140	1,777	491	0.44	0.03	101.4
12	1	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	2,445	1,533	7.86	0.77	97.6
12	2	C-17	C17VPF	PAT	17RC42	1.14 EPR	180	2,113	992	1.64	0.16	94.4
12	3	C-17	C17VPP	PAT	35RC13	1.34 EPR	170	2,397	2,095	6.79	0.32	94.1
12	4	C-17	C17IPE	PAT	17LC14	1.14 EPR	160	1,867	1,247	1.56	0.09	93.2
12	5	C-17	C17VPE	PAT	17RC44	1.14 EPR	180	2,603	1,247	2.27	0.24	92.0
12	6	C-17	C17VPJ	PAT	17LC42	1.14 EPR	180	2,390	1,299	0.46	0.00	91.9
12	7	C-17	C17TDH	DEP	35RD32	1.34 EPR	160	3,420	2,438	0.55	0.00	91.9
12	8	C-17	C17A17	ARR	17LA33	1.15 EPR	160	2,518	1,323	2.71	0.09	91.8
12	9	C-17	C17VPX	PAT	35RC42	1.34 EPR	170	3,679	2,655	0.25	0.00	91.1
12	10	C-17	C17VPW	PAT	35RC44	1.34 EPR	170	3,679	2,655	0.34	0.00	91.1
13	1	T-38C	T38D4	DEP	35LD12	100.00 % RPM	250	2,243	3,699	0.19	0.00	92.7
13	2	T-38C	T38D3	DEP	35LD11	100.00 % RPM	250	2,243	3,699	0.19	0.00	92.6
13	3	T-38C	T38C4	PAT	35LC11	100.00 % RPM	165	1,897	3,632	0.24	0.00	91.5

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
13	4	T-38C	T38C3	PAT	35LC12	100.00 % RPM	165	1,897	3,632	0.24	0.00	91.5
13	5	T-38C	T38D1	DEP	17RD11	100.00 % RPM	0	1,382	3,595	0.36	0.00	91.4
13	6	T-38C	T38D2	DEP	17RD12	100.00 % RPM	0	1,382	3,595	0.36	0.00	91.4
13	7	C-17	C17TDF	DEP	35LD32	1.42 EPR	145	2,002	3,648	1.17	0.00	91.1
13	8	C-17	C17TDE	DEP	35LD31	1.42 EPR	185	1,662	3,606	1.17	0.00	89.8
13	9	C-17	C17VPS	PAT	35LC45	1.34 EPR	140	1,854	3,626	0.23	0.02	89.6
13	10	C-17	C17VPR	PAT	35LC44	1.34 EPR	140	1,854	3,626	1.22	0.13	89.6
14	1	C-17	C17VPA	PAT	17RC13	1.34 EPR	170	2,729	1,415	0.44	0.03	98.1
14	2	C-17	C17VPB	PAT	17RC16	1.34 EPR	170	2,752	1,770	1.62	0.16	96.2
14	3	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,420	2,789	14.61	1.42	92.5
14	4	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,420	2,789	12.62	0.59	92.5
14	5	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,420	2,789	3.91	0.26	92.5
14	6	C-17	C17VPC	PAT	17RC17	1.34 EPR	170	2,748	2,651	2.29	0.11	92.5
14	7	C-17	C17VPM	PAT	35LC13	1.20 EPR	160	2,900	1,758	0.23	0.02	90.0
14	8	C-17	C17A40	ARR	35LA32	1.10 EPR	180	2,900	1,758	0.30	0.21	86.5
14	9	C-17	C17TDD	DEP	17RD32	1.34 EPR	250	4,756	4,654	2.17	0.00	86.2
14	10	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	3,398	6,162	1.03	0.00	86.0
15	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	165	2,289	971	0.24	0.00	106.3
15	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	165	2,289	971	0.24	0.00	106.3
15	3	C-17	C17VPO	PAT	35LC17	1.34 EPR	170	1,928	594	1.23	0.06	105.9
15	4	C-17	C17VPM	PAT	35LC13	1.34 EPR	170	1,973	636	0.23	0.02	105.2
15	5	C-17	C17VPN	PAT	35LC16	1.34 EPR	170	1,973	636	0.87	0.09	105.2
15	6	C-17	C17A24	ARR	17RA32	1.14 EPR	140	1,580	407	0.55	0.39	103.7
15	7	C-17	C17A35	ARR	17RA34	1.14 EPR	140	1,580	407	0.55	0.39	103.6
15	8	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	1,627	431	0.78	0.05	103.5
15	9	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	1,627	431	0.78	0.05	103.5
15	10	C-17	C17A18	ARR	17RA21	1.15 EPR	125	1,608	421	0.08	0.06	103.4
16	1	C-17	C17CPWA	PAT	17RCW	1.34 EPR	170	2,167	2,230	8.41	0.39	94.9
16	2	T-38C	T38C1	PAT	17RC11	100.00 % RPM	165	2,330	3,767	0.45	0.00	90.5
16	3	T-38C	T38C2	PAT	17RC12	100.00 % RPM	165	2,330	3,767	0.45	0.00	90.5
16	4	T-38C	T38D1	DEP	17RD11	100.00 % RPM	250	3,054	4,020	0.36	0.00	89.6
16	5	T-38C	T38D2	DEP	17RD12	100.00 % RPM	250	3,054	4,020	0.36	0.00	89.6
16	6	T-38C	T38D3	DEP	35LD11	100.00 % RPM	0	1,382	5,518	0.19	0.00	89.1
16	7	T-38C	T38D4	DEP	35LD12	100.00 % RPM	0	1,382	5,518	0.19	0.00	89.1
16	8	C-17	C17TDC	DEP	17RD31	1.42 EPR	250	2,270	3,761	2.17	0.00	88.8
16	9	C-17	C17TDD	DEP	17RD32	1.34 EPR	160	2,442	3,907	2.17	0.00	88.8
16	10	C-17	TC17D2	DEP	17RD12	1.34 EPR	160	2,459	3,803	0.06	0.00	88.7

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus FTU												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
1	1	C-17	C17VPE	PAT	17RC44	1.14 EPR	180	1,460	254	2.27	0.24	106.9
1	2	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	2,180	987	7.86	0.77	100.9
1	3	C-17	C17A16	ARR	17LA32	1.14 EPR	160	1,810	669	0.18	0.01	99.6
1	4	C-17	C17VPK	PAT	17LC44	1.14 EPR	180	2,173	825	0.63	0.00	96.5
1	5	C-17	C17IPE	PAT	17LC14	1.14 EPR	160	1,784	851	1.56	0.09	96.4
1	6	C-17	C17A7	ARR	17AA32	1.14 EPR	160	1,832	937	0.29	0.02	96.3
1	7	C-17	C17A8	ARR	17AA33	1.15 EPR	160	1,805	821	4.28	0.27	96.0
1	8	C-17	C17DD	DEP	35RD11	1.34 EPR	160	2,804	1,734	0.89	0.00	95.9
1	9	C-17	C17VPL	PAT	17LC45	1.14 EPR	180	2,120	862	0.12	0.00	95.9
1	10	C-17	C17A15	ARR	17LA32	1.14 EPR	180	2,244	888	0.18	0.01	95.6
2	1	C-17	C17A46	ARR	35RA32	1.10 EPR	200	2,000	736	0.10	0.00	97.1
2	2	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,651	2,395	14.61	1.42	92.3
2	3	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,651	2,395	12.62	0.59	92.3
2	4	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,651	2,395	3.91	0.26	92.3
2	5	KC-46X	46RCX	PAT	35RC13	60.00 % N1	180	1,702	476	3.83	0.88	91.4
2	6	C-17	C17VPP	PAT	35RC13	1.20 EPR	160	2,900	1,605	6.79	0.32	90.7
2	7	C-17	C17VPO	PAT	35LC17	1.20 EPR	160	2,900	1,604	1.23	0.06	90.6
2	8	KC-135R	135RDC	DEP	17LD32	92.00 % NF	185	2,841	1,904	0.19	0.03	89.9
2	9	C-17	C17TDB	DEP	17LD32	1.34 EPR	250	4,506	3,394	1.03	0.00	88.5
2	10	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	4,949	3,798	0.46	0.00	88.2
3	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	250	2,915	1,499	0.24	0.00	101.5
3	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	250	2,915	1,499	0.24	0.00	101.5
3	3	C-17	C17A18	ARR	17RA21	1.15 EPR	125	2,066	686	0.08	0.06	99.4
3	4	C-17	C17A19	ARR	17RA22	1.14 EPR	125	2,096	712	0.08	0.06	98.9
3	5	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	2,135	749	0.78	0.05	98.5
3	6	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	2,135	749	0.78	0.05	98.5
3	7	C-17	TC17A1	ARR	17RA11	1.14 EPR	140	2,119	733	0.09	0.03	98.3
3	8	C-17	C17AB	ARR	17RA11	1.14 EPR	140	2,119	733	1.25	0.00	98.3
3	9	C-17	C17VPI	PAT	17LC17	1.10 EPR	160	2,018	710	3.91	0.26	98.2
3	10	C-17	C17VPA	PAT	17RC13	1.10 EPR	160	2,020	711	0.44	0.03	98.2
4	1	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,034	945	14.61	1.42	102.1
4	2	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,034	945	12.62	0.59	102.1
4	3	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,034	945	3.91	0.26	102.1
4	4	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	2,537	1,658	1.03	0.00	97.4
4	5	C-17	C17TDA	DEP	17LD31	1.42 EPR	250	2,262	1,654	1.03	0.00	96.6
4	6	C-17	C17DA	DEP	17LD11	1.34 EPR	160	2,457	1,751	1.64	0.00	96.2
4	7	C-17	C17VPK	PAT	17LC44	1.34 EPR	170	2,726	1,781	0.63	0.00	96.1
4	8	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	2,726	1,781	0.46	0.00	96.1
4	9	C-17	C17VPL	PAT	17LC45	1.34 EPR	170	2,726	1,781	0.12	0.00	96.1
4	10	C-17	C17A42	ARR	35RA33	1.15 EPR	160	991	971	1.46	0.05	95.9
5	1	C-17	C17VPO	PAT	35LC17	1.34 EPR	170	2,255	996	1.23	0.06	101.2
5	2	C-17	C17VPM	PAT	35LC13	1.34 EPR	170	2,360	1,088	0.23	0.02	100.5
5	3	C-17	C17VPN	PAT	35LC16	1.34 EPR	170	2,360	1,088	0.87	0.09	100.5

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus FTU												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
5	4	C-17	C17TDH	DEP	35RD32	1.34 EPR	160	2,382	1,632	0.55	0.00	98.3
5	5	C-17	C17VPP	PAT	35RC13	1.34 EPR	170	1,943	1,517	6.79	0.32	98.0
5	6	KC-46X	46C9	PAT	35RC4	85.00 % N1	180	2,000	684	0.19	0.03	97.1
5	7	C-17	C17TDG	DEP	35RD31	1.42 EPR	250	1,882	1,656	0.55	0.00	96.6
5	8	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	1,884	1,655	7.86	0.77	96.5
5	9	C-17	C17VPX	PAT	35RC42	1.34 EPR	170	2,530	1,742	0.25	0.00	96.5
5	10	C-17	C17VPW	PAT	35RC44	1.34 EPR	170	2,530	1,742	0.34	0.00	96.5
6	1	C-17	C17A46	ARR	35RA32	1.10 EPR	200	2,000	727	0.10	0.00	96.7
6	2	KC-46X	46C4	PAT	17LC4	85.00 % N1	180	2,446	876	0.45	0.07	94.3
6	3	C-17	C17IPE	PAT	17LC14	1.20 EPR	160	1,982	1,454	1.56	0.09	92.8
6	4	C-17	C17VPH	PAT	17LC16	1.10 EPR	160	2,899	1,594	14.61	1.42	91.8
6	5	C-17	C17VPG	PAT	17LC13	1.10 EPR	160	2,899	1,594	12.62	0.59	91.8
6	6	C-17	C17VPI	PAT	17LC17	1.10 EPR	160	2,899	1,594	3.91	0.26	91.8
6	7	C-17	C17VPO	PAT	35LC17	1.20 EPR	160	2,900	1,594	1.23	0.06	91.0
6	8	C-17	C17VPP	PAT	35RC13	1.20 EPR	160	2,900	1,594	6.79	0.32	91.0
6	9	C-17	C17VPU	PAT	35RC16	1.20 EPR	160	2,898	1,592	7.86	0.77	90.8
6	10	C-17	C17VPN	PAT	35LC16	1.20 EPR	160	2,899	1,593	0.87	0.09	90.8
7	1	C-17	C17TDH	DEP	35RD32	1.40 EPR	0	1,382	1,609	0.55	0.00	101.4
7	2	C-17	C17TDG	DEP	35RD31	1.40 EPR	0	1,382	1,609	0.55	0.00	101.3
7	3	C-17	C17TDB	DEP	17LD32	1.42 EPR	145	1,751	1,660	1.03	0.00	98.7
7	4	C-17	C17TDA	DEP	17LD31	1.42 EPR	145	1,530	1,619	1.03	0.00	97.9
7	5	KC-135R	135RDL	DEP	35RD32	88.00 % NF	0	1,382	1,609	0.13	0.02	97.5
7	6	KC-135R	135RDK	DEP	35RD12	88.00 % NF	0	1,382	1,609	0.00	0.00	97.5
7	7	KC-135R	135RDJ	DEP	35RD11	88.00 % NF	0	1,382	1,609	0.01	0.00	97.5
7	8	C-17	C17DA	DEP	17LD11	1.34 EPR	130	1,751	1,660	1.64	0.00	97.1
7	9	C-17	C17VPK	PAT	17LC44	1.34 EPR	140	1,636	1,635	0.63	0.00	96.8
7	10	C-17	C17VPJ	PAT	17LC42	1.34 EPR	140	1,636	1,635	0.46	0.00	96.8
8	1	C-17	C17IPF	PAT	35RC14	1.14 EPR	160	1,899	1,062	0.84	0.05	94.0
8	2	C-17	C17VPQ	PAT	35LC42	1.14 EPR	180	2,295	1,174	0.88	0.09	93.1
8	3	KC-135R	135RDC	DEP	17LD32	92.00 % NF	185	2,572	1,361	0.19	0.03	92.6
8	4	KC-46X	46RDC	DEP	17LD32	92.00 % N1	185	2,559	1,350	0.12	0.07	91.3
8	5	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	3,892	2,656	1.03	0.00	91.0
8	6	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	4,254	2,996	0.46	0.00	90.3
8	7	C-17	C17VPK	PAT	17LC44	1.34 EPR	170	4,254	2,996	0.63	0.00	90.3
8	8	C-17	C17VPL	PAT	17LC45	1.34 EPR	170	4,254	2,996	0.12	0.00	90.3
8	9	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,479	2,989	14.61	1.42	90.2
8	10	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,479	2,989	12.62	0.59	90.2
9	1	T-38C	T38C2	PAT	17RC12	100.00 % RPM	250	2,513	1,183	0.45	0.00	104.1
9	2	T-38C	T38C1	PAT	17RC11	100.00 % RPM	250	2,513	1,183	0.45	0.00	104.1

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus FTU												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
9	3	C-17	C17A40	ARR	35LA32	1.14 EPR	160	1,722	407	0.30	0.21	104.0
9	4	C-17	C17A36	ARR	35LA34	1.14 EPR	160	1,721	406	0.30	0.21	103.9
9	5	C-17	C17A39	ARR	35LA23	1.15 EPR	125	1,769	451	0.04	0.03	103.0
9	6	C-17	C17A38	ARR	35LA22	1.15 EPR	125	1,769	451	0.04	0.03	103.0
9	7	C-17	C17A37	ARR	35LA21	1.15 EPR	125	1,769	451	0.04	0.03	103.0
9	8	C-17	C17IPC	PAT	35LC11	1.14 EPR	140	1,786	467	0.42	0.03	102.9
9	9	C-17	C17IPD	PAT	35LC12	1.14 EPR	140	1,786	467	0.42	0.03	102.9
9	10	C-17	C17VPV	PAT	35RC17	1.10 EPR	140	1,744	423	2.11	0.14	102.8
10	1	T-38C	T38C1	PAT	17RC11	100.00 % RPM	250	2,686	1,628	0.45	0.00	100.5
10	2	T-38C	T38C2	PAT	17RC12	100.00 % RPM	250	2,686	1,628	0.45	0.00	100.5
10	3	C-17	C17VPV	PAT	35RC17	1.10 EPR	140	1,875	798	2.11	0.14	97.0
10	4	C-17	TC17D2	DEP	17RD12	1.34 EPR	160	2,863	1,777	0.06	0.00	95.7
10	5	C-17	TC17D1	DEP	17RD11	1.34 EPR	160	2,863	1,777	0.06	0.00	95.7
10	6	C-17	C17DB	DEP	17RD11	1.34 EPR	160	2,863	1,777	3.44	0.28	95.7
10	7	C-17	C17A40	ARR	35LA32	1.14 EPR	160	1,848	1,054	0.30	0.21	95.2
10	8	T-38C	T38D1	DEP	17RD11	100.00 % RPM	250	3,702	2,544	0.36	0.00	95.0
10	9	T-38C	T38D2	DEP	17RD12	100.00 % RPM	250	3,702	2,544	0.36	0.00	95.0
10	10	C-17	C17A36	ARR	35LA34	1.14 EPR	160	1,846	1,052	0.30	0.21	94.8
11	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	250	2,561	1,201	0.24	0.00	103.9
11	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	250	2,561	1,201	0.24	0.00	103.9
11	3	C-17	C17A24	ARR	17RA32	1.14 EPR	160	1,785	497	0.55	0.39	102.2
11	4	C-17	C17A35	ARR	17RA34	1.14 EPR	160	1,785	497	0.55	0.39	102.1
11	5	C-17	C17A18	ARR	17RA21	1.15 EPR	125	1,804	512	0.08	0.06	101.8
11	6	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	1,845	544	0.78	0.05	101.5
11	7	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	1,845	544	0.78	0.05	101.5
11	8	C-17	C17VPI	PAT	17LC17	1.10 EPR	140	1,777	489	3.91	0.26	101.4
11	9	C-17	C17A19	ARR	17RA22	1.14 EPR	125	1,822	526	0.08	0.06	101.4
11	10	C-17	C17VPA	PAT	17RC13	1.10 EPR	140	1,777	491	0.44	0.03	101.4
12	1	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	2,445	1,533	7.86	0.77	97.6
12	2	C-17	C17VPF	PAT	17RC42	1.14 EPR	180	2,113	993	1.64	0.16	94.4
12	3	C-17	C17VPP	PAT	35RC13	1.34 EPR	170	2,397	2,095	6.79	0.32	94.1
12	4	C-17	C17IPE	PAT	17LC14	1.14 EPR	160	1,867	1,247	1.56	0.09	93.2
12	5	C-17	C17VPE	PAT	17RC44	1.14 EPR	180	2,603	1,247	2.27	0.24	92.0
12	6	C-17	C17VPJ	PAT	17LC42	1.14 EPR	180	2,390	1,299	0.46	0.00	91.9
12	7	C-17	C17TDH	DEP	35RD32	1.34 EPR	160	3,420	2,438	0.55	0.00	91.9
12	8	C-17	C17A17	ARR	17LA33	1.15 EPR	160	2,518	1,323	2.71	0.09	91.8
12	9	C-17	C17VPX	PAT	35RC42	1.34 EPR	170	3,679	2,655	0.25	0.00	91.1
12	10	C-17	C17VPW	PAT	35RC44	1.34 EPR	170	3,679	2,655	0.34	0.00	91.1
13	1	T-38C	T38D4	DEP	35LD12	100.00 % RPM	250	2,243	3,699	0.19	0.00	92.7
13	2	T-38C	T38D3	DEP	35LD11	100.00 % RPM	250	2,243	3,699	0.19	0.00	92.6

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus FTU												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
13	3	T-38C	T38C4	PAT	35LC11	100.00 % RPM	165	1,897	3,632	0.24	0.00	91.5
13	4	T-38C	T38C3	PAT	35LC12	100.00 % RPM	165	1,897	3,632	0.24	0.00	91.5
13	5	T-38C	T38D1	DEP	17RD11	100.00 % RPM	0	1,382	3,595	0.36	0.00	91.4
13	6	T-38C	T38D2	DEP	17RD12	100.00 % RPM	0	1,382	3,595	0.36	0.00	91.4
13	7	C-17	C17TDF	DEP	35LD32	1.42 EPR	145	2,002	3,648	1.17	0.00	91.1
13	8	C-17	C17TDE	DEP	35LD31	1.42 EPR	185	1,662	3,606	1.17	0.00	89.8
13	9	C-17	C17VPS	PAT	35LC45	1.34 EPR	140	1,854	3,626	0.23	0.02	89.6
13	10	C-17	C17VPR	PAT	35LC44	1.34 EPR	140	1,854	3,626	1.22	0.13	89.6
14	1	C-17	C17VPA	PAT	17RC13	1.34 EPR	170	2,729	1,415	0.44	0.03	98.1
14	2	C-17	C17VPB	PAT	17RC16	1.34 EPR	170	2,752	1,770	1.62	0.16	96.2
14	3	KC-46X	46C4	PAT	17LC4	85.00 % N1	180	2,204	888	0.45	0.07	95.7
14	4	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,420	2,789	14.61	1.42	92.5
14	5	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,420	2,789	12.62	0.59	92.5
14	6	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,420	2,789	3.91	0.26	92.5
14	7	C-17	C17VPC	PAT	17RC17	1.34 EPR	170	2,748	2,651	2.29	0.11	92.5
14	8	C-17	C17VPM	PAT	35LC13	1.20 EPR	160	2,900	1,758	0.23	0.02	90.0
14	9	C-17	C17A40	ARR	35LA32	1.10 EPR	180	2,900	1,758	0.30	0.21	86.5
14	10	C-17	C17TDD	DEP	17RD32	1.34 EPR	250	4,756	4,654	2.17	0.00	86.2
15	1	T-38C	T38C4	PAT	35LC11	100.00 % RPM	165	2,289	971	0.24	0.00	106.3
15	2	T-38C	T38C3	PAT	35LC12	100.00 % RPM	165	2,289	971	0.24	0.00	106.3
15	3	C-17	C17VPO	PAT	35LC17	1.34 EPR	170	1,928	594	1.23	0.06	105.9
15	4	C-17	C17VPM	PAT	35LC13	1.34 EPR	170	1,973	636	0.23	0.02	105.2
15	5	C-17	C17VPN	PAT	35LC16	1.34 EPR	170	1,973	636	0.87	0.09	105.2
15	6	C-17	C17A24	ARR	17RA32	1.14 EPR	140	1,580	407	0.55	0.39	103.7
15	7	C-17	C17A35	ARR	17RA34	1.14 EPR	140	1,580	407	0.55	0.39	103.6
15	8	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	1,627	431	0.78	0.05	103.5
15	9	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	1,627	431	0.78	0.05	103.5
15	10	C-17	C17A18	ARR	17RA21	1.15 EPR	125	1,608	421	0.08	0.06	103.4
16	1	C-17	C17CPWA	PAT	17RCW	1.34 EPR	170	2,167	2,230	8.41	0.39	94.9
16	2	T-38C	T38C1	PAT	17RC11	100.00 % RPM	165	2,330	3,767	0.45	0.00	90.5
16	3	T-38C	T38C2	PAT	17RC12	100.00 % RPM	165	2,330	3,767	0.45	0.00	90.5
16	4	T-38C	T38D1	DEP	17RD11	100.00 % RPM	250	3,054	4,020	0.36	0.00	89.6
16	5	T-38C	T38D2	DEP	17RD12	100.00 % RPM	250	3,054	4,020	0.36	0.00	89.6
16	6	C-17	C17TDC	DEP	17RD31	1.42 EPR	250	2,270	3,761	2.17	0.00	88.8
16	7	C-17	C17TDD	DEP	17RD32	1.34 EPR	160	2,442	3,907	2.17	0.00	88.8
16	8	C-17	TC17D2	DEP	17RD12	1.34 EPR	160	2,459	3,803	0.06	0.00	88.7
16	9	C-17	TC17D1	DEP	17RD11	1.34 EPR	160	2,459	3,803	0.06	0.00	88.7
16	10	C-17	C17DB	DEP	17RD11	1.34 EPR	160	2,459	3,803	3.44	0.28	88.7

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
1	1	C-17	C17VPE	PAT	17RC44	1.14 EPR	180	1,474	71	2.27	0.24	109.0
1	2	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	2,179	798	7.86	0.77	102.9
1	3	C-17	C17A16	ARR	17LA32	1.14 EPR	160	1,809	543	0.18	0.01	101.4
1	4	C-17	C17IPE	PAT	17LC14	1.14 EPR	160	1,784	552	1.56	0.09	100.7
1	5	C-17	C17A8	ARR	17AA33	1.15 EPR	160	1,805	631	4.28	0.27	98.9
1	6	C-17	C17VPK	PAT	17LC44	1.14 EPR	180	2,184	807	0.63	0.00	96.8
1	7	C-17	C17A15	ARR	17LA32	1.14 EPR	180	2,244	802	0.18	0.01	96.6
1	8	C-17	C17DD	DEP	35RD11	1.34 EPR	160	2,784	1,868	0.89	0.00	95.2
1	9	KC-135R	135RCB	PAT	17LC14	65.00 % NF	160	1,784	552	0.46	0.07	94.3
1	10	C-17	C17IPF	PAT	35RC14	1.30 EPR	160	2,679	1,795	0.84	0.05	93.8
2	1	C-17	C17A46	ARR	35RA32	1.10 EPR	200	2,000	736	0.10	0.00	97.1
2	2	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,651	2,395	14.61	1.42	92.3
2	3	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,651	2,395	12.62	0.59	92.3
2	4	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,651	2,395	3.91	0.26	92.3
2	5	KC-46X	46RCX	PAT	35RC13	60.00 % N1	180	1,702	476	1.21	0.14	91.4
2	6	C-17	C17VPP	PAT	35RC13	1.20 EPR	160	2,900	1,604	6.79	0.32	90.7
2	7	C-17	C17VPO	PAT	35LC17	1.20 EPR	160	2,900	1,603	1.23	0.06	90.6
2	8	KC-135R	135RDC	DEP	17LD32	92.00 % NF	185	2,841	1,904	0.19	0.03	88.8
2	9	C-17	C17TDB	DEP	17LD32	1.34 EPR	250	4,506	3,394	1.03	0.00	88.5
2	10	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	4,949	3,798	0.46	0.00	88.2
3	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	250	2,915	1,499	0.24	0.00	101.5
3	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	250	2,915	1,499	0.24	0.00	101.5
3	3	C-17	C17A18	ARR	17RA21	1.15 EPR	125	2,066	685	0.08	0.06	99.4
3	4	C-17	C17A19	ARR	17RA22	1.14 EPR	125	2,096	712	0.08	0.06	98.9
3	5	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	2,135	749	0.78	0.05	98.5
3	6	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	2,135	749	0.78	0.05	98.5
3	7	C-17	TC17A1	ARR	17RA11	1.14 EPR	140	2,119	733	0.09	0.03	98.3
3	8	C-17	C17AB	ARR	17RA11	1.14 EPR	140	2,119	733	1.25	0.00	98.3
3	9	C-17	C17VPI	PAT	17LC17	1.10 EPR	160	2,018	710	3.91	0.26	98.2
3	10	C-17	C17VPA	PAT	17RC13	1.10 EPR	160	2,020	711	0.44	0.03	98.2
4	1	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,034	945	14.61	1.42	102.1
4	2	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,034	945	12.62	0.59	102.1
4	3	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,034	945	3.91	0.26	102.1
4	4	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	2,537	1,658	1.03	0.00	97.4
4	5	C-17	C17TDA	DEP	17LD31	1.42 EPR	250	2,262	1,654	1.03	0.00	96.6
4	6	C-17	C17DA	DEP	17LD11	1.34 EPR	160	2,457	1,751	1.64	0.00	96.2
4	7	C-17	C17VPK	PAT	17LC44	1.34 EPR	170	2,726	1,781	0.63	0.00	96.1
4	8	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	2,726	1,781	0.46	0.00	96.1
4	9	C-17	C17VPL	PAT	17LC45	1.34 EPR	170	2,726	1,781	0.12	0.00	96.1
4	10	C-17	C17A42	ARR	35RA33	1.15 EPR	160	991	971	1.46	0.05	95.9
5	1	C-17	C17VPO	PAT	35LC17	1.34 EPR	170	2,255	996	1.23	0.06	101.2

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
5	2	C-17	C17VPM	PAT	35LC13	1.34 EPR	170	2,360	1,088	0.23	0.02	100.5
5	3	C-17	C17VPN	PAT	35LC16	1.34 EPR	170	2,360	1,088	0.87	0.09	100.5
5	4	C-17	C17TDH	DEP	35RD32	1.34 EPR	160	2,382	1,632	0.55	0.00	98.3
5	5	C-17	C17VPP	PAT	35RC13	1.34 EPR	170	1,943	1,517	6.79	0.32	98.0
5	6	KC-46X	46C9	PAT	35RC4	85.00 % N1	180	2,000	683	0.20	0.02	97.1
5	7	C-17	C17TDG	DEP	35RD31	1.42 EPR	250	1,882	1,656	0.55	0.00	96.6
5	8	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	1,884	1,655	7.86	0.77	96.5
5	9	C-17	C17VPX	PAT	35RC42	1.34 EPR	170	2,530	1,742	0.25	0.00	96.5
5	10	C-17	C17VPW	PAT	35RC44	1.34 EPR	170	2,530	1,742	0.34	0.00	96.5
6	1	C-17	C17A46	ARR	35RA32	1.10 EPR	200	2,000	727	0.10	0.00	96.7
6	2	KC-46X	46C4	PAT	17LC4	85.00 % N1	180	2,446	876	0.47	0.05	94.3
6	3	C-17	C17IPE	PAT	17LC14	1.20 EPR	160	1,982	1,454	1.56	0.09	92.8
6	4	C-17	C17VPH	PAT	17LC16	1.10 EPR	160	2,899	1,594	14.61	1.42	91.8
6	5	C-17	C17VPG	PAT	17LC13	1.10 EPR	160	2,899	1,594	12.62	0.59	91.8
6	6	C-17	C17VPI	PAT	17LC17	1.10 EPR	160	2,899	1,594	3.91	0.26	91.7
6	7	C-17	C17VPO	PAT	35LC17	1.20 EPR	160	2,900	1,594	1.23	0.06	91.0
6	8	C-17	C17VPP	PAT	35RC13	1.20 EPR	160	2,900	1,594	6.79	0.32	91.0
6	9	C-17	C17VPU	PAT	35RC16	1.20 EPR	160	2,898	1,592	7.86	0.77	90.8
6	10	C-17	C17VPN	PAT	35LC16	1.20 EPR	160	2,899	1,593	0.87	0.09	90.8
7	1	C-17	C17TDH	DEP	35RD32	1.40 EPR	0	1,382	1,609	0.55	0.00	101.4
7	2	C-17	C17TDG	DEP	35RD31	1.40 EPR	0	1,382	1,609	0.55	0.00	101.3
7	3	C-17	C17TDB	DEP	17LD32	1.42 EPR	145	1,751	1,660	1.03	0.00	98.7
7	4	C-17	C17TDA	DEP	17LD31	1.42 EPR	145	1,530	1,620	1.03	0.00	97.9
7	5	KC-135R	135RDL	DEP	35RD32	88.00 % NF	0	1,382	1,609	0.13	0.02	97.5
7	6	KC-135R	135RDK	DEP	35RD12	88.00 % NF	0	1,382	1,609	0.00	0.00	97.5
7	7	KC-135R	135RDJ	DEP	35RD11	88.00 % NF	0	1,382	1,609	0.01	0.00	97.5
7	8	C-17	C17DA	DEP	17LD11	1.34 EPR	130	1,751	1,660	1.64	0.00	97.1
7	9	C-17	C17VPK	PAT	17LC44	1.34 EPR	140	1,636	1,635	0.63	0.00	96.8
7	10	C-17	C17VPJ	PAT	17LC42	1.34 EPR	140	1,636	1,635	0.46	0.00	96.8
8	1	C-17	C17IPF	PAT	35RC14	1.14 EPR	160	1,899	1,063	0.84	0.05	94.0
8	2	C-17	C17VPQ	PAT	35LC42	1.14 EPR	180	2,295	1,174	0.88	0.09	93.1
8	3	KC-135R	135RDC	DEP	17LD32	92.00 % NF	185	2,572	1,361	0.19	0.03	91.7
8	4	KC-46X	46RDC	DEP	17LD32	92.00 % N1	185	2,559	1,350	0.19	0.00	91.3
8	5	C-17	C17TDB	DEP	17LD32	1.34 EPR	160	3,892	2,656	1.03	0.00	91.0
8	6	C-17	C17VPJ	PAT	17LC42	1.34 EPR	170	4,254	2,996	0.46	0.00	90.3
8	7	C-17	C17VPK	PAT	17LC44	1.34 EPR	170	4,254	2,996	0.63	0.00	90.3
8	8	C-17	C17VPL	PAT	17LC45	1.34 EPR	170	4,254	2,996	0.12	0.00	90.3
8	9	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,479	2,989	14.61	1.42	90.2

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
8	10	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,479	2,989	12.62	0.59	90.2
9	1	T-38C	T38C2	PAT	17RC12	100.00 % RPM	250	2,513	1,182	0.45	0.00	104.1
9	2	T-38C	T38C1	PAT	17RC11	100.00 % RPM	250	2,513	1,182	0.45	0.00	104.1
9	3	C-17	C17A40	ARR	35LA32	1.14 EPR	160	1,722	406	0.30	0.21	104.0
9	4	C-17	C17A36	ARR	35LA34	1.14 EPR	160	1,721	406	0.30	0.21	103.9
9	5	C-17	C17A39	ARR	35LA23	1.15 EPR	125	1,769	451	0.04	0.03	103.1
9	6	C-17	C17A38	ARR	35LA22	1.15 EPR	125	1,769	451	0.04	0.03	103.1
9	7	C-17	C17A37	ARR	35LA21	1.15 EPR	125	1,769	451	0.04	0.03	103.1
9	8	C-17	C17IPD	PAT	35LC12	1.14 EPR	140	1,786	467	0.42	0.03	102.9
9	9	C-17	C17IPC	PAT	35LC11	1.14 EPR	140	1,786	467	0.42	0.03	102.9
9	10	C-17	C17VPV	PAT	35RC17	1.10 EPR	140	1,744	423	2.11	0.14	102.9
10	1	T-38C	T38C1	PAT	17RC11	100.00 % RPM	250	2,686	1,627	0.45	0.00	100.5
10	2	T-38C	T38C2	PAT	17RC12	100.00 % RPM	250	2,686	1,627	0.45	0.00	100.5
10	3	C-17	C17VPV	PAT	35RC17	1.10 EPR	140	1,875	798	2.11	0.14	97.0
10	4	C-17	TC17D2	DEP	17RD12	1.34 EPR	160	2,863	1,777	0.06	0.00	95.7
10	5	C-17	TC17D1	DEP	17RD11	1.34 EPR	160	2,863	1,777	0.06	0.00	95.7
10	6	C-17	C17DB	DEP	17RD11	1.34 EPR	160	2,863	1,777	3.44	0.28	95.7
10	7	C-17	C17A40	ARR	35LA32	1.14 EPR	160	1,848	1,053	0.30	0.21	95.2
10	8	T-38C	T38D1	DEP	17RD11	100.00 % RPM	250	3,702	2,544	0.36	0.00	95.0
10	9	T-38C	T38D2	DEP	17RD12	100.00 % RPM	250	3,702	2,544	0.36	0.00	95.0
10	10	C-17	C17A36	ARR	35LA34	1.14 EPR	160	1,846	1,052	0.30	0.21	94.8
11	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	250	2,561	1,201	0.24	0.00	103.9
11	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	250	2,561	1,201	0.24	0.00	103.9
11	3	C-17	C17A24	ARR	17RA32	1.14 EPR	160	1,785	497	0.55	0.39	102.2
11	4	C-17	C17A35	ARR	17RA34	1.14 EPR	160	1,785	497	0.55	0.39	102.0
11	5	C-17	C17A18	ARR	17RA21	1.15 EPR	125	1,804	512	0.08	0.06	101.8
11	6	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	1,845	544	0.78	0.05	101.5
11	7	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	1,845	544	0.78	0.05	101.5
11	8	C-17	C17VPI	PAT	17LC17	1.10 EPR	140	1,777	490	3.91	0.26	101.4
11	9	C-17	C17A19	ARR	17RA22	1.14 EPR	125	1,822	526	0.08	0.06	101.4
11	10	C-17	C17VPA	PAT	17RC13	1.10 EPR	140	1,777	491	0.44	0.03	101.4
12	1	C-17	C17VPU	PAT	35RC16	1.34 EPR	170	2,445	1,533	7.86	0.77	97.6
12	2	C-17	C17VPF	PAT	17RC42	1.14 EPR	180	2,113	992	1.64	0.16	94.4
12	3	C-17	C17VPP	PAT	35RC13	1.34 EPR	170	2,397	2,095	6.79	0.32	94.1
12	4	C-17	C17IPE	PAT	17LC14	1.14 EPR	160	1,867	1,247	1.56	0.09	93.2
12	5	C-17	C17VPE	PAT	17RC44	1.14 EPR	180	2,603	1,247	2.27	0.24	92.0
12	6	C-17	C17VPJ	PAT	17LC42	1.14 EPR	180	2,390	1,299	0.46	0.00	91.9
12	7	C-17	C17TDH	DEP	35RD32	1.34 EPR	160	3,420	2,438	0.55	0.00	91.9

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
12	8	C-17	C17A17	ARR	17LA33	1.15 EPR	160	2,518	1,323	2.71	0.09	91.8
12	9	C-17	C17VPX	PAT	35RC42	1.34 EPR	170	3,679	2,655	0.25	0.00	91.1
12	10	C-17	C17VPW	PAT	35RC44	1.34 EPR	170	3,679	2,655	0.34	0.00	91.1
13	1	T-38C	T38D4	DEP	35LD12	100.00 % RPM	250	2,243	3,699	0.19	0.00	92.7
13	2	T-38C	T38D3	DEP	35LD11	100.00 % RPM	250	2,243	3,699	0.19	0.00	92.6
13	3	T-38C	T38C4	PAT	35LC11	100.00 % RPM	165	1,897	3,632	0.24	0.00	91.5
13	4	T-38C	T38C3	PAT	35LC12	100.00 % RPM	165	1,897	3,632	0.24	0.00	91.5
13	5	T-38C	T38D1	DEP	17RD11	100.00 % RPM	0	1,382	3,595	0.36	0.00	91.4
13	6	T-38C	T38D2	DEP	17RD12	100.00 % RPM	0	1,382	3,595	0.36	0.00	91.4
13	7	C-17	C17TDF	DEP	35LD32	1.42 EPR	145	2,002	3,648	1.17	0.00	91.1
13	8	C-17	C17TDE	DEP	35LD31	1.42 EPR	185	1,662	3,606	1.17	0.00	89.8
13	9	C-17	C17VPS	PAT	35LC45	1.34 EPR	140	1,854	3,626	0.23	0.02	89.6
13	10	C-17	C17VPR	PAT	35LC44	1.34 EPR	140	1,854	3,626	1.22	0.13	89.6
14	1	C-17	C17VPA	PAT	17RC13	1.34 EPR	170	2,729	1,415	0.44	0.03	98.1
14	2	C-17	C17VPB	PAT	17RC16	1.34 EPR	170	2,752	1,770	1.62	0.16	96.2
14	3	KC-46X	46C4	PAT	17LC4	85.00 % N1	180	2,204	888	0.47	0.05	95.7
14	4	C-17	C17VPH	PAT	17LC16	1.34 EPR	170	2,420	2,789	14.61	1.42	92.5
14	5	C-17	C17VPG	PAT	17LC13	1.34 EPR	170	2,420	2,789	12.62	0.59	92.5
14	6	C-17	C17VPI	PAT	17LC17	1.34 EPR	170	2,420	2,789	3.91	0.26	92.5
14	7	C-17	C17VPC	PAT	17RC17	1.34 EPR	170	2,748	2,651	2.29	0.11	92.5
14	8	C-17	C17VPM	PAT	35LC13	1.20 EPR	160	2,900	1,758	0.23	0.02	90.0
14	9	C-17	C17A40	ARR	35LA32	1.10 EPR	180	2,900	1,758	0.30	0.21	86.5
14	10	C-17	C17TDD	DEP	17RD32	1.34 EPR	250	4,756	4,654	2.17	0.00	86.2
15	1	T-38C	T38C3	PAT	35LC12	100.00 % RPM	165	2,289	971	0.24	0.00	106.3
15	2	T-38C	T38C4	PAT	35LC11	100.00 % RPM	165	2,289	971	0.24	0.00	106.3
15	3	C-17	C17VPO	PAT	35LC17	1.34 EPR	170	1,928	594	1.23	0.06	105.9
15	4	C-17	C17VPM	PAT	35LC13	1.34 EPR	170	1,973	636	0.23	0.02	105.2
15	5	C-17	C17VPN	PAT	35LC16	1.34 EPR	170	1,973	636	0.87	0.09	105.2
15	6	C-17	C17A24	ARR	17RA32	1.14 EPR	140	1,580	407	0.55	0.39	103.7
15	7	C-17	C17A35	ARR	17RA34	1.14 EPR	140	1,580	407	0.55	0.39	103.6
15	8	C-17	C17IPA	PAT	17RC11	1.14 EPR	140	1,627	431	0.78	0.05	103.5
15	9	C-17	C17IPB	PAT	17RC12	1.14 EPR	140	1,627	431	0.78	0.05	103.5
15	10	C-17	C17A18	ARR	17RA21	1.15 EPR	125	1,608	421	0.08	0.06	103.4
16	1	C-17	C17CPWA	PAT	17RCW	1.34 EPR	170	2,167	2,230	8.41	0.39	94.9
16	2	T-38C	T38C1	PAT	17RC11	100.00 % RPM	165	2,330	3,767	0.45	0.00	90.5

Table C-1-1. Noise Contributors at Representative Locations Near Altus AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

Altus MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Dist. (ft)	Operations		SEL (dB)
										Day	Night	
16	3	T-38C	T38C2	PAT	17RC12	100.00 % RPM	165	2,330	3,767	0.45	0.00	90.5
16	4	T-38C	T38D1	DEP	17RD11	100.00 % RPM	250	3,054	4,020	0.36	0.00	89.6
16	5	T-38C	T38D2	DEP	17RD12	100.00 % RPM	250	3,054	4,020	0.36	0.00	89.6
16	6	C-17	C17TDC	DEP	17RD31	1.42 EPR	250	2,270	3,761	2.17	0.00	88.8
16	7	C-17	C17TDD	DEP	17RD32	1.34 EPR	160	2,442	3,907	2.17	0.00	88.8
16	8	C-17	TC17D2	DEP	17RD12	1.34 EPR	160	2,459	3,803	0.06	0.00	88.7
16	9	C-17	TC17D1	DEP	17RD11	1.34 EPR	160	2,459	3,803	0.06	0.00	88.7
16	10	C-17	C17DB	DEP	17RD11	1.34 EPR	160	2,459	3,803	3.44	0.28	88.7

Key: ARR= Arrival; DEP= Departure; PAT= Closed Pattern.

Power Units: EPR: engine pressure ratio; N1 = engine speed at Location No. 1; NF = engine fan revolutions per minute; RPM = revolutions per minute.

Source: NOISEMAP Version 7.2.

Table C-1-2. Noise Contributors at Representative Locations Near Fairchild AFB Under Baseline and MOB 1 Scenario

Fairchild Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,010	2,725	0.04	0.00	113.5
1	2	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,207	3,589	0.05	0.00	103.7
1	3	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	4,987	0.11	0.00	101.4
1	4	F-18A/C	F18DB	DEP	23D03	95.00 % NC	0	2,462	4,987	0.16	0.00	97.9
1	5	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,745	2,202	0.16	0.00	97.9
1	6	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,340	2,925	0.01	0.00	97.0
1	7	C-9A	C9DB	DEP	23D04	2.00 EPR	0	2,462	4,987	0.02	0.00	95.9
1	8	C-9A	C9DA	DEP	05D04	2.00 EPR	200	4,124	2,789	0.01	0.00	95.7
1	9	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,692	2,194	0.11	0.00	95.0
1	10	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	94.9
2	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	5,269	3,005	0.11	0.00	112.6
2	2	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	3,164	1,252	0.05	0.00	103.2
2	3	EA-6B	EA6AA	ARR	05A03	75.00 % RPM	160	3,015	1,174	0.04	0.00	101.1
2	4	F-18A/C	F18DB	DEP	23D03	94.00 % NC	300	6,571	4,341	0.16	0.00	99.5
2	5	F-16C	F16DB	DEP	23D04	90.00 % NC	350	5,391	3,193	0.02	0.00	94.8
2	6	C-9A	C9DB	DEP	23D04	1.80 EPR	250	5,164	2,906	0.02	0.00	91.2
2	7	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	12,559	0.04	0.00	90.9
2	8	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	90.1
2	9	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	90.0
2	10	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	90.0
3	1	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	5,742	0.04	0.00	110.6
3	2	EA-6B	EA6DB	DEP	23D03	99.50 % RPM	145	3,032	5,759	0.11	0.00	109.2
3	3	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	5,742	0.05	0.00	107.6
3	4	AH-1W	UH1I04	INT	UH1I04	n/a*	n/a*	n/a*	n/a*	0.19	0.01	104.5
3	5	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	3,994	5,918	0.16	0.00	103.2
3	6	F-16C	F16DA	DEP	05D04	91.50 % NC	0	2,462	5,742	0.01	0.00	98.0
3	7	F-16C	F16DB	DEP	23D04	91.00 % NC	300	3,586	5,830	0.02	0.00	94.5
3	4	AH-1W	UH1I02	INT	UH1I02	n/a*	n/a*	n/a*	n/a*	0.04	0.01	93.8
3	9	C-9A	C9DA	DEP	05D04	2.00 EPR	0	2,462	5,742	0.01	0.00	92.8
3	10	C-9A	C9DB	DEP	23D04	2.00 EPR	115	3,316	5,789	0.02	0.00	91.7
4	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	3,427	2,301	0.11	0.00	115.8
4	2	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	2,257	0.04	0.00	109.4
4	3	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	4,588	2,993	0.16	0.00	106.2
4	4	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	2,257	0.05	0.00	105.9
4	5	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	103.2
4	6	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	103.1
4	7	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0	103.1
4	8	AH-1W	UH1D02	DEP	UH1D02	n/a*	n/a*	n/a*	n/a*	0.01	0	102.5
4	9	F-16C	F16DB	DEP	23D04	91.00 % NC	300	3,955	2,564	0.02	0.00	98.7
4	10	AH-1W	UH1A05	ARR	UH1A05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	98.0
5	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,258	2,181	0.04	0.00	115.6
5	2	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,837	883	0.16	0.00	105.8
5	3	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	105.2
5	4	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,470	3,301	0.05	0.00	104.3
5	5	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,763	849	0.11	0.00	103.8
5	6	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	102.2
5	7	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	6,292	0.11	0.00	99.2

Table C-1-2. Noise Contributors at Representative Locations Near Fairchild AFB Under Baseline and MOB 1 Scenario (Continued)

Fairchild Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
5	8	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,527	2,271	0.01	0.00	99.1
5	9	AH-1W	UH1I03	INT	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	98.7
5	10	C-9A	C9DA	DEP	05D04	2.00 EPR	200	4,371	2,132	0.01	0.00	97.8
6	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,629	2,945	0.04	0.00	112.4
6	2	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,984	614	0.16	0.00	108.9
6	3	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,876	508	0.11	0.00	108.0
6	4	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	106.5
6	5	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	103.9
6	6	C-17	C17CD	PAT	23C2	70.00 % NC	150	2,512	178	0.12	0.00	102.4
6	7	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,865	3,992	0.05	0.00	101.6
6	8	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,825	2,459	0.01	0.00	97.9
6	9	AH-1W	UH1I03	DEP	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	97.9
6	10	C-9A	C9AB	ARR	23A01	1.35 EPR	135	3,000	630	0.02	0.00	96.2
7	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	3,555	3,174	0.11	0.00	112.4
7	2	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	3,391	0.04	0.00	104.9
7	3	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	4,723	3,767	0.16	0.00	103.9
7	4	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	3,391	0.05	0.00	102.2
7	5	F-16C	F16DB	DEP	23D04	91.00 % NC	300	4,039	3,375	0.02	0.00	96.1
7	6	C-9A	C9DB	DEP	23D04	2.00 EPR	115	3,784	3,260	0.02	0.00	94.7
7	7	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	2,597	2,966	0.05	0.00	94.0
7	8	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	93.5
7	9	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	93.5
7	10	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	93.5
8	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	4,463	2,055	0.11	0.00	116.3
8	2	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	2,889	455	0.05	0.00	111.2
8	3	EA-6B	EA6AA	ARR	05A03	75.00 % RPM	160	2,803	368	0.04	0.00	110.5
8	4	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	5,680	3,295	0.16	0.00	104.3
8	5	C-17	C17CC	PAT	05C2	70.00 % NC	150	2,512	77	0.04	0.00	102.4
8	6	F-16C	F16DB	DEP	23D04	91.00 % NC	300	4,633	2,210	0.02	0.00	99.3
8	7	C-9A	C9AA	ARR	05A01	1.35 EPR	135	2,902	467	0.01	0.00	99.1
8	8	KC-135R	T135AA	ARR	05A01	66.50 % NF	150	2,766	331	0.15	0.02	98.3
8	9	F-16C	F16AA	ARR	05A01	80.00 % NC	160	2,803	368	0.01	0.00	98.0
8	10	C-17	C17AA	ARR	05A01	70.00 % NC	140	2,803	368	0.08	0.00	98.0
9	1	EA-6B	EA6DB	DEP	23D03	99.50 % RPM	145	3,055	4,405	0.11	0.00	109.8
9	2	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	4,366	0.04	0.00	107.2
9	3	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	4,366	0.05	0.00	104.3
9	4	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	4,046	4,649	0.16	0.00	103.0
9	5	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	99.8
9	6	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	99.6
9	7	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	99.6
9	8	AH-1W	UH1I01	INT	UH1I01	n/a*	n/a*	n/a*	n/a*	0.09	0.01	96.4
9	9	F-16C	F16DA	DEP	05D04	91.50 % NC	0	2,462	4,366	0.01	0.00	95.2
9	10	AH-1W	UH1A05	ARR	UH1A05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	95.0
10	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	3,638	2,194	0.04	0.00	116.0
10	2	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	2,820	0.11	0.00	109.7
10	3	F-18A/C	F18DB	DEP	23D03	95.00 % NC	0	2,462	2,820	0.16	0.00	106.8

Table C-1-2. Noise Contributors at Representative Locations Near Fairchild AFB Under Baseline and MOB 1 Scenario (Continued)

Fairchild Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
10	4	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	4,810	3,035	0.05	0.00	105.8
10	5	C-9A	C9DB	DEP	23D04	2.00 EPR	0	2,462	2,820	0.02	0.00	104.5
10	6	F-16C	F16DB	DEP	23D04	91.50 % NC	0	2,462	2,820	0.02	0.00	103.5
10	7	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,624	1,818	0.16	0.00	99.1
10	8	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,094	2,476	0.01	0.00	98.8
10	9	C-9A	C9DA	DEP	05D04	2.00 EPR	115	3,840	2,310	0.01	0.00	97.9
10	10	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,599	1,815	0.11	0.00	96.4
11	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	4,034	2,387	0.11	0.00	115.0
11	2	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	5,228	3,348	0.16	0.00	104.6
11	3	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	2,752	1,750	0.05	0.00	100.0
11	4	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	98.4
11	5	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	98.4
11	6	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	98.3
11	7	C-17	C17CD	PAT	23C2	89.60 % NC	190	3,036	519	0.12	0.00	98.3
11	8	F-16C	F16DB	DEP	23D04	91.00 % NC	300	4,353	2,610	0.02	0.00	98.0
11	9	EA-6B	EA6AA	ARR	05A03	75.00 % RPM	160	2,697	1,740	0.04	0.00	97.3
11	10	C-9A	C9DB	DEP	23D04	2.00 EPR	200	4,141	2,459	0.02	0.00	96.8
12	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,108	3,243	0.04	0.00	112.9
12	2	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	112.8
12	3	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	111.2
12	4	AH-1W	UH1I03	INT	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	103.6
12	5	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,273	4,016	0.05	0.00	103.2
12	6	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	5,513	0.11	0.00	100.1
12	7	AH-1W	UH1A04	ARR	UH1A04	n/a*	n/a*	n/a*	n/a*	0.72	0.04	99.2
12	8	AH-1W	UH1D02	DEP	UH1D02	n/a*	n/a*	n/a*	n/a*	0.01	0.00	98.5
12	9	AH-1W	UH1C02	PAT	UH1C02	n/a*	n/a*	n/a*	n/a*	0.28	0.02	98.1
12	10	C-17	C17CC	PAT	05C2	89.60 % NC	190	3,044	436	0.04	0.00	97.2
13	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,189	1,929	0.04	0.00	117.3
13	2	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	110.7
13	3	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	109.9
13	4	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,385	3,099	0.05	0.00	105.3
13	5	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,793	941	0.16	0.00	105.3
13	6	AH-1W	UH1I03	INT	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	104.0
13	7	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,729	917	0.11	0.00	103.1
13	8	AH-1W	UH1A06	ARR	UH1A06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	101.8
13	9	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	5,475	0.11	0.00	100.7
13	10	AH-1W	UH1D02	DEP	UH1D02	n/a*	n/a*	n/a*	n/a*	0.01	0.00	100.5
Fairchild MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,010	2,724	0.04	0.00	113.9
1	2	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,207	3,588	0.05	0.00	103.6
1	3	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	4,987	0.11	0.00	101.9
1	4	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,745	2,202	0.16	0.00	98.0
1	5	F-18A/C	F18DB	DEP	23D03	95.00 % NC	0	2,462	4,987	0.16	0.00	97.9
1	6	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,340	2,923	0.01	0.00	97.0

Table C-1-2. Noise Contributors at Representative Locations Near Fairchild AFB Under Baseline and MOB 1 Scenario (Continued)

Fairchild MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	7	C-9A	C9DA	DEP	05D04	2.00 EPR	200	4,124	2,788	0.01	0.00	95.6
1	8	C-9A	C9DB	DEP	23D04	2.00 EPR	0	2,462	4,987	0.02	0.00	95.6
1	9	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,692	2,194	0.11	0.00	95.4
1	10	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	94.9
2	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	5,269	2,994	0.11	0.00	113.0
2	2	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	3,164	1,250	0.05	0.00	103.5
2	3	EA-6B	EA6AA	ARR	05A03	75.00 % RPM	160	3,015	1,173	0.04	0.00	101.6
2	4	F-18A/C	F18DB	DEP	23D03	94.00 % NC	300	6,571	4,330	0.16	0.00	99.3
2	5	F-16C	F16DB	DEP	23D04	90.00 % NC	350	5,391	3,182	0.02	0.00	94.8
2	6	C-9A	C9DB	DEP	23D04	1.80 EPR	250	5,164	2,895	0.02	0.00	91.2
2	7	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	12,559	0.04	0.00	90.5
2	8	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	90.2
2	9	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	90.1
2	10	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	90.1
3	1	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	5,744	0.04	0.00	109.7
3	2	EA-6B	EA6DB	DEP	23D03	99.50 % RPM	145	3,032	5,759	0.11	0.00	108.2
3	3	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	5,744	0.05	0.00	106.4
3	4	AH-1W	UH1I04	INT	UH1I04	n/a*	n/a*	n/a*	n/a*	0.19	0.01	104.7
3	5	F-16C	F16DA	DEP	05D04	91.50 % NC	0	2,462	5,744	0.01	0.00	96.8
3	6	AH-1W	UH1I02	INT	UH1I02	n/a*	n/a*	n/a*	n/a*	0.04	0.01	94.5
3	7	F-16C	F16DB	DEP	23D04	91.00 % NC	300	3,586	5,830	0.02	0.00	91.6
3	8	C-9A	C9DA	DEP	05D04	2.00 EPR	0	2,462	5,744	0.01	0.00	91.6
3	9	C-9A	C9DB	DEP	23D04	2.00 EPR	115	3,316	5,788	0.02	0.00	90.3
3	10	KC-135R	T135DA	DEP	05D04	89.60 % NF	30	2,462	5,744	0.15	0.02	89.9
4	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	3,427	2,301	0.11	0.00	116.3
4	2	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	2,255	0.04	0.00	109.8
4	3	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	4,587	2,994	0.16	0.00	106.3
4	4	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	2,255	0.05	0.00	106.1
4	5	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	103.2
4	6	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	103.1
4	7	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0	103.1
4	8	AH-1W	UH1D02	DEP	UH1D02	n/a*	n/a*	n/a*	n/a*	0.01	0	102.5
4	9	F-16C	F16DB	DEP	23D04	91.00 % NC	300	3,955	2,565	0.02	0.00	98.8
4	10	AH-1W	UH1A05	ARR	UH1A05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	98.0
5	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,258	2,181	0.04	0.00	116.2
5	2	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,837	883	0.16	0.00	106.1
5	3	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	105.2
5	4	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,470	3,301	0.05	0.00	104.2
5	5	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,763	849	0.11	0.00	104.2
5	6	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	102.2
5	7	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	6,292	0.11	0.00	100.2
5	8	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,527	2,271	0.01	0.00	99.3
5	9	AH-1W	UH1I03	INT	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	98.7
5	10	C-9A	C9DA	DEP	05D04	2.00 EPR	200	4,370	2,132	0.01	0.00	97.9
6	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,630	2,941	0.04	0.00	112.8
6	2	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,984	610	0.16	0.00	109.2

Table C-1-2. Noise Contributors at Representative Locations Near Fairchild AFB Under Baseline and MOB 1 Scenario (Continued)

Fairchild MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
6	3	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,876	504	0.11	0.00	108.3
6	4	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	106.6
6	5	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	103.9
6	6	C-17	C17CD	PAT	23C2	70.00 % NC	150	2,512	175	0.12	0.00	102.6
6	7	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,865	3,988	0.05	0.00	101.4
6	8	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,825	2,455	0.01	0.00	98.1
6	9	AH-1W	UH1I03	DEP	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	97.9
6	10	C-9A	C9AB	ARR	23A01	1.35 EPR	135	3,000	625	0.02	0.00	97.4
7	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	3,555	3,174	0.11	0.00	112.7
7	2	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	3,394	0.04	0.00	105.3
7	3	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	4,723	3,768	0.16	0.00	103.8
7	4	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	3,394	0.05	0.00	102.3
7	5	F-16C	F16DB	DEP	23D04	91.00 % NC	300	4,039	3,376	0.02	0.00	96.0
7	6	C-9A	C9DB	DEP	23D04	2.00 EPR	115	3,784	3,261	0.02	0.00	94.5
7	7	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	2,597	2,970	0.05	0.00	93.9
7	8	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	93.5
7	9	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	93.5
7	10	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	93.5
8	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	4,463	2,047	0.11	0.00	116.9
8	2	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	2,889	446	0.05	0.00	111.5
8	3	EA-6B	EA6AA	ARR	05A03	75.00 % RPM	160	2,803	359	0.04	0.00	111.0
8	4	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	5,680	3,286	0.16	0.00	104.3
8	5	C-17	C17CC	PAT	05C2	70.00 % NC	150	2,512	67	0.04	0.00	102.6
8	6	C-9A	C9AA	ARR	05A01	1.35 EPR	135	2,902	458	0.01	0.00	100.2
8	7	F-16C	F16DB	DEP	23D04	91.00 % NC	300	4,633	2,202	0.02	0.00	99.5
8	8	KC-135R	T135AA	ARR	05A01	66.50 % NF	150	2,766	322	0.15	0.02	98.7
8	9	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	7,246	0.04	0.00	98.5
8	10	C-17	C17AA	ARR	05A01	70.00 % NC	140	2,803	359	0.08	0.00	98.4
9	1	EA-6B	EA6DB	DEP	23D03	99.50 % RPM	145	3,055	4,405	0.11	0.00	109.8
9	2	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	4,363	0.04	0.00	107.2
9	3	F-18A/C	F18DA	DEP	05D03	95.00 % NC	0	2,462	4,363	0.05	0.00	103.9
9	4	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	4,046	4,649	0.16	0.00	102.7
9	5	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	99.8
9	6	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	99.6
9	7	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	99.6
9	8	AH-1W	UH1I01	INT	UH1I01	n/a*	n/a*	n/a*	n/a*	0.09	0.01	96.4
9	9	AH-1W	UH1A05	ARR	UH1A05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	95.0
9	10	F-16C	F16DA	DEP	05D04	91.50 % NC	0	2,462	4,363	0.01	0.00	94.9
10	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	3,638	2,193	0.04	0.00	116.5
10	2	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	2,820	0.11	0.00	110.4
10	3	F-18A/C	F18DB	DEP	23D03	95.00 % NC	0	2,462	2,820	0.16	0.00	106.9
10	4	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	4,810	3,034	0.05	0.00	105.8
10	5	C-9A	C9DB	DEP	23D04	2.00 EPR	0	2,462	2,820	0.02	0.00	104.5
10	6	F-16C	F16DB	DEP	23D04	91.50 % NC	0	2,462	2,820	0.02	0.00	103.5
10	7	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,624	1,818	0.16	0.00	99.3
10	8	F-16C	F16DA	DEP	05D04	91.00 % NC	300	4,094	2,475	0.01	0.00	98.9

Table C-1-2. Noise Contributors at Representative Locations Near Fairchild AFB Under Baseline and MOB 1 Scenario (Continued)

Fairchild MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
10	9	C-9A	C9DA	DEP	05D04	2.00 EPR	115	3,840	2,309	0.01	0.00	97.9
10	10	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,599	1,815	0.11	0.00	96.8
11	1	EA-6B	EA6DB	DEP	23D03	98.00 % RPM	250	4,034	2,390	0.11	0.00	115.5
11	2	F-18A/C	F18DB	DEP	23D03	96.70 % NC	250	5,228	3,351	0.16	0.00	104.6
11	3	EA-6B	EA6DA	DEP	05D03	99.00 % RPM	0	2,462	4,917	0.04	0.00	100.7
11	7	F-18A/C	F18AA	ARR	05A03	86.10 % NC	140	2,752	1,747	0.05	0.00	100.2
11	8	C-17	C17CD	PAT	23C2	89.60 % NC	190	3,036	524	0.12	0.00	99.5
11	9	F-16C	F16DB	DEP	23D04	91.00 % NC	300	4,353	2,613	0.02	0.00	98.1
11	4	AH-1W	UH1D06	DEP	UH1D06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	98.0
11	5	AH-1W	UH1D05	DEP	UH1D05	n/a*	n/a*	n/a*	n/a*	0.04	0.00	98.0
11	6	AH-1W	UH1D04	DEP	UH1D04	n/a*	n/a*	n/a*	n/a*	0.71	0.04	98.0
11	10	EA-6B	EA6AA	ARR	05A03	75.00 % RPM	160	2,697	1,736	0.04	0.00	97.8
12	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,108	3,243	0.04	0.00	113.2
12	2	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	113.0
12	3	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	111.1
12	4	AH-1W	UH1I03	INT	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	103.6
12	5	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,272	4,015	0.05	0.00	102.9
12	6	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	5,513	0.11	0.00	100.5
12	7	AH-1W	UH1A04	ARR	UH1A04	n/a*	n/a*	n/a*	n/a*	0.72	0.04	99.2
12	4	C-17	C17CC	PAT	05C2	89.60 % NC	190	3,044	434	0.04	0.00	98.6
12	8	AH-1W	UH1D02	DEP	UH1D02	n/a*	n/a*	n/a*	n/a*	0.01	0.00	98.5
12	9	AH-1W	UH1C02	PAT	UH1C02	n/a*	n/a*	n/a*	n/a*	0.28	0.02	98.1
13	1	EA-6B	EA6DA	DEP	05D03	98.00 % RPM	250	4,189	1,930	0.04	0.00	117.9
13	2	AH-1W	UH1D03	DEP	UH1D03	n/a*	n/a*	n/a*	n/a*	0.04	0.00	110.7
13	3	AH-1W	UH1D01	DEP	UH1D01	n/a*	n/a*	n/a*	n/a*	0.24	0.01	109.9
13	2	F-18A/C	F18AB	ARR	23A03	86.10 % NC	140	2,793	941	0.16	0.00	105.6
13	3	F-18A/C	F18DA	DEP	05D03	96.70 % NC	250	5,385	3,100	0.05	0.00	105.3
13	6	AH-1W	UH1I03	INT	UH1I03	n/a*	n/a*	n/a*	n/a*	0.28	0.02	104.0
13	4	EA-6B	EA6AB	ARR	23A03	75.00 % RPM	160	2,729	917	0.11	0.00	103.5
13	8	AH-1W	UH1A06	ARR	UH1A06	n/a*	n/a*	n/a*	n/a*	0.13	0.01	101.8
13	5	EA-6B	EA6DB	DEP	23D03	99.00 % RPM	0	2,462	5,475	0.11	0.00	101.7
13	10	AH-1W	UH1D02	DEP	UH1D02	n/a*	n/a*	n/a*	n/a*	0.01	0.00	100.5

Key: ARR= Arrival; DEP= Departure; INT= Interfacility; PAT= Closed Pattern; Power Units: EPR: engine pressure ratio; N1 = engine speed at Location No. 1; NC = core engine speed; RPM = revolutions per minute.
* = Rotorcraft Noise Model (RNM) is a simulation-based model and does not report SEL based on a single point of closest approach.
Source: NOISEMAP Version 7.2 and RNM.

Table C-1-3. Noise Contributors at Representative Locations Near Grand Forks AFB Under Baseline and MOB 1 Scenario

Grand Forks Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4,408	3,615	0.30	0.00	96.5
1	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4,609	3,831	0.00	0.15	94.5
1	3	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1,591	1,081	0.02	0.00	92.9
1	4	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1,591	1,081	0.03	0.00	92.1
1	5	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1,956	1,341	0.00	0.35	91.3
1	6	KC-135R	135AB	ARR	35A3	65.00 % NF	150	1,422	984	0.07	0.01	90.0
1	7	C-130H&N&P	130C	ARR	35A3	650.00 C TIT	110	1,418	982	0.02	0.00	89.5
1	8	T-45	MQ4AB	ARR	35A11	85.20 % RPM	180	1,463	1,006	0.00	0.70	88.6
1	9	C-20	C-20-C	ARR	35A3	2400.00 LBS	150	1,418	982	0.03	0.00	87.6
1	10	C-130H&N&P	130B	DEP	17D1	932.00 C TIT	170	2,341	1,659	0.01	0.00	87.0
2	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4,077	3,312	0.30	0.00	97.3
2	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4,187	3,436	0.00	0.15	95.7
2	3	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1,388	1,022	0.02	0.00	93.6
2	4	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1,388	1,022	0.03	0.00	92.7
2	5	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1,675	1,184	0.00	0.35	92.5
2	6	KC-135R	135AB	ARR	35A3	65.00 % NF	150	1,292	980	0.07	0.01	90.0
2	7	C-130H&N&P	130C	ARR	35A3	650.00 C TIT	110	1,289	979	0.02	0.00	89.3
2	8	T-45	MQ4AB	ARR	35A11	85.20 % RPM	180	1,321	992	0.00	0.70	88.7
2	9	C-130H&N&P	130B	DEP	17D1	977.00 C TIT	130	2,098	1,493	0.01	0.00	88.4
2	10	C-20	C-20-C	ARR	35A3	2400.00 LBS	150	1,289	979	0.03	0.00	87.6
3	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3,907	3,451	0.70	0.00	97.1
3	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	3,966	3,518	0.00	0.35	95.6
3	3	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1,771	1,857	0.00	0.15	89.5
3	4	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1,247	1,668	0.00	0.30	89.1
3	5	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1,299	1,680	0.07	0.01	88.9
3	6	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	160	1,299	1,680	0.04	0.00	88.4
3	7	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	130	1,973	1,959	0.02	0.00	86.4
3	8	KC-135R	135AA	ARR	17A1	65.00 % NF	150	1,209	1,660	0.03	0.00	85.5
3	9	C-130H&N&P	130D	ARR	17A1	650.00 C TIT	110	1,207	1,660	0.01	0.00	84.7
3	10	C-21A	C21A	DEP	35D1	96.00 % NC	180	2,872	2,575	0.02	0.00	84.5
4	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	4,176	5,194	0.70	0.00	92.8
4	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	4,302	5,288	0.00	0.35	91.2
4	3	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	2,091	4,181	0.00	0.15	82.9
4	4	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	8,415	0.30	0.00	81.7
4	5	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1,360	4,028	0.00	0.30	81.1
4	6	KC-135R	135DB	DEP	35D1	87.00 % NF	200	1,444	4,039	0.07	0.01	80.8
4	7	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	130	2,164	4,200	0.02	0.00	79.4
4	8	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	200	1,444	4,039	0.04	0.00	78.7
4	9	C-21A	C21A	DEP	35D1	96.00 % NC	180	3,104	4,579	0.02	0.00	78.6
4	10	KC-135R	135AA	ARR	17A1	65.00 % NF	150	1,307	4,022	0.03	0.00	76.9
5	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3,903	3,187	0.70	0.00	97.7
5	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	3,961	3,257	0.00	0.35	96.2
5	3	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	160	1,298	1,034	0.04	0.00	93.6
5	4	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1,245	1,015	0.00	0.30	93.0
5	5	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1,298	1,034	0.07	0.01	92.8
5	6	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1,766	1,301	0.00	0.15	92.0
5	7	KC-135R	135AA	ARR	17A1	65.00 % NF	150	1,207	1,002	0.03	0.00	89.7

Table C-1-3. Noise Contributors at Representative Locations Near Grand Forks AFB Under Baseline and MOB 1 Scenario (Continued)

Grand Forks Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
5	8	C-130H&N&P	130D	ARR	17A1	650.00 C TIT	110	1,205	1,001	0.01	0.00	89.0
5	9	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	130	1,970	1,444	0.02	0.00	89.0
5	10	C-20	C-20-A	ARR	17A1	2400.00 LBS	150	1,205	1,001	0.02	0.00	87.3
6	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4,077	5,408	0.30	0.00	92.4
6	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4,188	5,485	0.00	0.15	90.9
6	3	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1,676	4,440	0.00	0.35	82.8
6	4	T-45	MQ4DB	DEP	35D8	100.00 % RPM	0	911	7,991	0.70	0.00	82.5
6	5	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1,388	4,400	0.03	0.00	79.8
6	6	C-130H&N&P	130B	DEP	17D1	977.00 C TIT	130	2,099	4,532	0.01	0.00	78.3
6	7	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1,388	4,400	0.02	0.00	77.6
6	8	C-21A	C21B	DEP	17D1	96.00 % NC	180	3,025	4,859	0.01	0.00	77.4
6	9	CESSNA-441 TPROP	MQ9CB PCCB	PAT	17C8	50.00 % RPM	85	1,911	1,276	1.58	1.05	76.7
6	10	KC-135R	135AB	ARR	35A3	65.00 % NF	150	1,292	4,391	0.07	0.01	76.0
7	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3,814	9,974	0.70	0.00	85.1
7	2	T-45	MQ4CB	PAT	35C9	85.00 % RPM	200	6,911	8,248	0.00	0.35	83.4
7	3	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911 1	578	0.30	0.00	79.3
7	4	T-45	MQ4CA	PAT	17C9	85.00 % RPM	200	6,911	8,248	0.00	0.15	77.7
7	5	CESSNA-441 TPROP	MQ9CB PCD	PAT	35C8	75.00 % RPM	150	1,911	1,091	3.68	2.45	77.5
7	6	CESSNA-441 TPROP	MQ9CB PCCB	PAT	17C8	50.00 % RPM	85	1,911	1,488	1.58	1.05	75.8
7	7	C-130H&N&P	130A	DEP	35D1	932.00 C TIT	170	7,013	6,604	0.02	0.00	74.6
7	8	KC-135R	135DB	DEP	35D1	87.00 % NF	250	9,996	9,537	0.07	0.01	72.3
7	9	T-41	MQ1ND ANG~2	PAT	35C8	75.00 % RPM	150	2,000	1,173	6.86	0.00	72.1
7	10	C-21A	C21A	DEP	35D1	96.00 % NC	180	9,133	8,637	0.02	0.00	71.9
8	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3,324	5,319	0.70	0.00	92.6
8	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	180	3,324	5,319	0.00	0.35	91.3
8	3	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	5,209	0.30	0.00	86.4
8	4	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1,307	4,705	0.00	0.15	84.8
8	5	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1,202	4,696	0.07	0.01	79.5
8	6	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	130	1,696	4,754	0.02	0.00	78.6
8	7	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1,083	4,690	0.00	0.30	78.5
8	8	C-21A	C21A	DEP	35D1	96.00 % NC	180	2,534	4,967	0.02	0.00	77.7
8	9	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	160	1,202	4,696	0.04	0.00	77.3
8	10	C-21A	C21B	DEP	17D1	96.00 % NC	0	911	5,209	0.01	0.00	74.0
9	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4,408	3,935	0.30	0.00	95.6
9	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4,608	4,134	0.00	0.15	93.7
9	3	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1,955	2,048	0.00	0.35	88.1
9	4	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1,591	1,887	0.03	0.00	87.5
9	5	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1,591	1,887	0.02	0.00	86.8
9	6	KC-135R	135AB	ARR	35A3	65.00 % NF	150	1,421	1,833	0.07	0.01	84.8
9	7	C-130H&N&P	130B	DEP	17D1	932.00 C TIT	170	2,340	2,270	0.01	0.00	84.4
9	8	C-130H&N&P	130C	ARR	35A3	650.00 C TIT	110	1,418	1,832	0.02	0.00	84.1
9	9	T-45	MQ4AB	ARR	35A11	85.20 % RPM	180	1,463	1,845	0.00	0.70	83.8
9	10	C-21A	C21B	DEP	17D1	96.00 % NC	180	3,315	2,987	0.01	0.00	82.8
10	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	4,199	3,648	0.70	0.00	96.4

Table C-1-3. Noise Contributors at Representative Locations Near Grand Forks AFB Under Baseline and MOB 1 Scenario (Continued)

Grand Forks Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
10	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	4,331	3,786	0.00	0.35	94.7
10	3	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1,370	1,545	0.00	0.30	89.8
10	4	KC-135R	135DB	DEP	35D1	87.00 % NF	200	1,458	1,575	0.07	0.01	89.2
10	5	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	2,118	1,925	0.00	0.15	88.8
10	6	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	200	1,458	1,575	0.04	0.00	88.8
10	7	KC-135R	135AA	ARR	17A1	65.00 % NF	150	1,315	1,529	0.03	0.00	86.3
10	8	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	130	2,180	1,959	0.02	0.00	86.0
10	9	C-130H&N&P	130D	ARR	17A1	650.00 C TIT	110	1,312	1,528	0.01	0.00	85.6
10	10	C-21A	C21A	DEP	35D1	96.00 % NC	180	3,124	2,686	0.02	0.00	84.0
11	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	2,953	3,313	0.70	0.00	97.4
11	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	180	2,953	3,313	0.00	0.35	96.3
11	3	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	2,666	0.30	0.00	91.9
11	4	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1,085	2,543	0.00	0.15	89.6
11	5	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1,156	2,549	0.07	0.01	85.2
11	6	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	105	1,570	2,624	0.02	0.00	84.3
11	7	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	160	1,156	2,549	0.04	0.00	83.8
11	8	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1,005	2,538	0.00	0.30	83.6
11	9	C-21A	C21B	DEP	17D1	96.00 % NC	0	911	2,666	0.01	0.00	83.5
11	10	C-21A	C21A	DEP	35D1	96.00 % NC	180	2,373	2,939	0.02	0.00	83.3
Grand Forks MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4408	3615	0.30	0.00	96.5
1	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4609	3831	0.00	0.15	94.5
1	3	KC-46X	46DA	DEP	17D1	92.00 % N1	185	1687	1142	2.04	0.04	93.1
1	4	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1591	1081	0.02	0.00	92.9
1	5	KC-46X	46CG	PAT	35C2	65.00 % N1	170	1453	559	16.11	1.79	92.4
1	6	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1591	1081	0.03	0.00	92.1
1	7	KC-46X	46CI	PAT	35C6	60.00 % N1	240	1399	474	6.04	0.67	91.8
1	8	KC-46X	46AF	ARR	35A6	65.00 % N1	170	1342	624	0.59	0.07	91.6
1	9	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1956	1341	0.00	0.35	91.3
1	10	KC-46X	46AG	ARR	35A8	65.00 % N1	180	1397	738	0.71	0.08	90.5
2	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4077	3312	0.30	0.00	97.3
2	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4187	3436	0.00	0.15	95.7
2	3	KC-46X	46DA	DEP	17D1	92.00 % N1	185	1530	1095	2.04	0.04	93.7
2	4	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1388	1022	0.02	0.00	93.6
2	5	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1388	1022	0.03	0.00	92.7
2	6	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1675	1184	0.00	0.35	92.5
2	7	KC-46X	46CE	PAT	17C7	85.00 % N1	190	2116	1286	2.59	0.29	91.2
2	8	KC-135R	135AB	ARR	35A3	65.00 % NF	150	1292	980	0.07	0.01	90.0
2	9	KC-46X	46CC	PAT	17C5	85.00 % N1	200	1734	1431	5.18	0.58	89.5
2	10	C-130H&N&P	130C	ARR	35A3	650.00 C TIT	110	1289	979	0.02	0.00	89.3
3	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3907	3451	0.70	0.00	97.1
3	2	KC-46X	46CG	PAT	35C2	85.00 % N1	200	1469	799	16.11	1.79	95.9

Table C-1-3. Noise Contributors at Representative Locations Near Grand Forks AFB Under Baseline and MOB 1 Scenario (Continued)

Grand Forks MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
3	3	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	3966	3518	0.00	0.35	95.6
3	4	KC-46X	46CF	PAT	35C1	88.00 % N1	200	1676	806	11.69	1.30	95.4
3	5	KC-46X	46DC	DEP	35D1	92.00 % N1	160	1299	1680	4.76	0.09	89.7
3	6	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1771	1857	0.00	0.15	89.5
3	7	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1247	1668	0.00	0.30	89.1
3	8	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1299	1680	0.07	0.01	88.9
3	9	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	160	1299	1680	0.04	0.00	88.4
3	10	KC-46X	46CH	PAT	35C5	85.00 % N1	200	1668	1772	12.08	1.34	87.9
4	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	4176	5194	0.70	0.00	92.8
4	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	4302	5288	0.00	0.35	91.2
4	3	KC-46X	46CF	PAT	35C1	88.00 % N1	200	1878	1488	11.69	1.30	89.8
4	4	KC-46X	46CG	PAT	35C2	85.00 % N1	200	1555	1629	16.11	1.79	88.1
4	5	KC-46X	46DD	DEP	35D7	92.00 % N1	200	3361	2505	1.31	0.00	85.2
4	6	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	2091	4181	0.00	0.15	82.9
4	7	KC-46X	46CI	PAT	35C6	85.00 % N1	190	1635	2912	6.04	0.67	82.8
4	8	KC-46X	46CH	PAT	35C5	85.00 % N1	200	2018	2905	12.08	1.34	82.3
4	9	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	8415	0.30	0.00	81.7
4	10	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1360	4028	0.00	0.30	81.1
5	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3903	3187	0.70	0.00	97.7
5	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	3961	3257	0.00	0.35	96.2
5	3	KC-46X	46DC	DEP	35D1	92.00 % N1	160	1298	1034	4.76	0.09	94.7
5	4	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	160	1298	1034	0.04	0.00	93.6
5	5	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1245	1015	0.00	0.30	93.0
5	6	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1298	1034	0.07	0.01	92.8
5	7	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1766	1301	0.00	0.15	92.0
5	8	KC-46X	46CH	PAT	35C5	85.00 % N1	200	1647	1230	12.08	1.34	91.3
5	9	KC-46X	46CJ	PAT	35C7	85.00 % N1	190	1980	1302	6.04	0.67	91.2
5	10	KC-135R	135AA	ARR	17A1	65.00 % NF	150	1207	1002	0.03	0.00	89.7
6	1	KC-46X	46CB	PAT	17C2	85.00 % N1	200	1562	1001	6.91	0.77	93.9
6	2	KC-46X	46CA	PAT	17C1	85.00 % N1	200	1891	1093	5.01	0.56	93.0
6	3	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4077	5408	0.30	0.00	92.4
6	4	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4188	5485	0.00	0.15	90.9
6	5	KC-46X	46CD	PAT	17C6	85.00 % N1	190	1641	2164	2.59	0.29	86.3
6	6	KC-46X	46DB	DEP	17D7	92.00 % N1	200	3360	2452	0.56	0.00	86.1
6	7	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1676	4440	0.00	0.35	82.8
6	8	T-45	MQ4DB	DEP	35D8	100.00 % RPM	0	911	7991	0.70	0.00	82.5
6	9	KC-46X	46CC	PAT	17C5	85.00 % N1	200	1992	3633	5.18	0.58	79.8
6	10	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1388	4400	0.03	0.00	79.8
7	1	KC-46X	46CG	PAT	35C2	85.00 % N1	200	1747	1062	16.11	1.79	93.9
7	2	KC-46X	46CI	PAT	35C6	85.00 % N1	190	1822	1063	6.04	0.67	93.9

Table C-1-3. Noise Contributors at Representative Locations Near Grand Forks AFB Under Baseline and MOB 1 Scenario (Continued)

Grand Forks MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
7	3	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3814	9974	0.70	0.00	85.1
7	4	KC-46X	46CF	PAT	35C1	88.00 % N1	200	2276	2286	11.69	1.30	85.0
7	5	T-45	MQ4CB	PAT	35C9	85.00 % RPM	200	6911	8248	0.00	0.35	83.4
7	6	KC-46X	46DD	DEP	35D7	92.00 % N1	200	3651	3616	1.31	0.00	82.7
7	7	KC-46X	46AC	ARR	17A8	65.00 % N1	200	1911	1833	0.30	0.03	80.8
7	8	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	10578	0.30	0.00	79.3
7	9	T-45	MQ4CA	PAT	17C9	85.00 % RPM	200	6911	8248	0.00	0.15	77.7
7	10	KC-46X	46AB	ARR	17A6	65.00 % N1	190	1910	2662	0.25	0.03	77.6
8	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	3324	5319	0.70	0.00	92.6
8	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	180	3324	5319	0.00	0.35	91.3
8	3	KC-46X	46CI	PAT	35C6	85.00 % N1	190	1596	2407	6.04	0.67	86.7
8	4	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	5209	0.30	0.00	86.4
8	5	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1307	4705	0.00	0.15	84.8
8	6	KC-46X	46AF	ARR	35A6	60.00 % N1	220	2052	1333	0.59	0.07	82.1
8	7	KC-46X	46DD	DEP	35D7	92.00 % N1	185	2322	4486	1.31	0.00	81.9
8	8	KC-46X	46CG	PAT	35C2	85.00 % N1	200	1508	3735	16.11	1.79	80.1
8	9	KC-46X	46CF	PAT	35C1	88.00 % N1	200	1676	3990	11.69	1.30	79.8
8	10	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1202	4696	0.07	0.01	79.5
9	1	T-45	MQ4DA	DEP	17D8	100.00 % RPM	150	4408	3935	0.30	0.00	95.6
9	2	T-45	MQ4CA	PAT	17C9	100.00 % RPM	200	4608	4134	0.00	0.15	93.7
9	3	T-45	MQ4CB	PAT	35C9	88.00 % RPM	180	1955	2048	0.00	0.35	88.1
9	4	KC-46X	46CE	PAT	17C7	85.00 % N1	190	2364	1646	2.59	0.29	87.9
9	5	KC-135R	135DA	DEP	17D1	87.00 % NF	200	1591	1887	0.03	0.00	87.5
9	6	KC-46X	46DA	DEP	17D1	92.00 % N1	185	1687	1923	2.04	0.04	87.5
9	7	KC-10A	KC-10-B	DEP	17D1	87.00 % N1	200	1591	1887	0.02	0.00	86.8
9	8	KC-135R	135AB	ARR	35A3	65.00 % NF	150	1421	1833	0.07	0.01	84.8
9	9	C-130H&N&P	130B	DEP	17D1	932.00 C TIT	170	2340	2270	0.01	0.00	84.4
9	10	C-130H&N&P	130C	ARR	35A3	650.00 C TIT	110	1418	1832	0.02	0.00	84.1
10	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	4199	3648	0.70	0.00	96.4
10	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	200	4331	3786	0.00	0.35	94.7
10	3	KC-46X	46DC	DEP	35D1	92.00 % N1	185	1458	1575	4.76	0.09	90.1
10	4	KC-46X	46CJ	PAT	35C7	85.00 % N1	190	2229	1454	6.04	0.67	89.9
10	5	T-45	MQ4AA	ARR	17A11	88.00 % RPM	180	1370	1545	0.00	0.30	89.8
10	6	KC-135R	135DB	DEP	35D1	87.00 % NF	200	1458	1575	0.07	0.01	89.2
10	7	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	2118	1925	0.00	0.15	88.8
10	8	KC-10A	KC-10-D	DEP	35D1	87.00 % N1	200	1458	1575	0.04	0.00	88.8
10	9	KC-46X	46CE	PAT	17C7	65.00 % N1	180	1302	1167	2.59	0.29	86.5
10	10	KC-135R	135AA	ARR	17A1	65.00 % NF	150	1315	1529	0.03	0.00	86.3
11	1	T-45	MQ4DB	DEP	35D8	100.00 % RPM	150	2953	3313	0.70	0.00	97.4
11	2	T-45	MQ4CB	PAT	35C9	100.00 % RPM	180	2953	3313	0.00	0.35	96.3
11	3	T-45	MQ4DA	DEP	17D8	100.00 % RPM	0	911	2666	0.30	0.00	91.9
11	4	T-45	MQ4CA	PAT	17C9	88.00 % RPM	180	1085	2543	0.00	0.15	89.6
11	5	KC-46X	46CI	PAT	35C6	85.00 % N1	190	1441	2051	6.04	0.67	88.4

Table C-1-3. Noise Contributors at Representative Locations Near Grand Forks AFB Under Baseline and MOB 1 Scenario (Continued)

Grand Forks MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
11	6	KC-46X	46DD	DEP	35D7	92.00 % N1	185	1329	2575	1.31	0.00	86.1
11	7	KC-135R	135DB	DEP	35D1	87.00 % NF	160	1156	2549	0.07	0.01	85.2
11	8	KC-46X	46DC	DEP	35D1	92.00 % N1	160	1149	2548	4.76	0.09	84.9
11	9	C-130H&N&P	130A	DEP	35D1	977.00 C TIT	105	1570	2624	0.02	0.00	84.3
11	10	KC-46X	46CF	PAT	35C1	88.00 % N1	200	1330	2568	11.69	1.30	84.2

Key: Power Units: C TIT = Turbine Inlet Temperature in Celsius; LBS= Pounds of Thrust; N1 = engine speed at Location No. 1; NC = core engine speed; NF = engine fan revolutions per minute; RPM = revolutions per minute.
Source: NOISEMAP Version 7.2.

Table C-1-4. Noise Contributors at Representative Locations Near McConnell AFB Under Baseline, FTU and MOB 1 Scenarios

McConnell Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	F-16C	F16C-DK	DEP	9RD4	90.00 % NC	250	1,811	4,552	1.19	0.04	94.2
1	2	F-16C	F16C-CB	PAT	9LC1	92.00 % NC	250	2,215	5,429	0.38	0.00	93.9
1	3	B-747-20A	747-D2	DEP	9RD4	34530.00 LBS	153	3,001	4,845	0.15	0.00	86.7
1	4	T-38C	T38C-DS	DEP	9RD4	95.00 % RPM	250	3,089	4,889	1.19	0.04	85.9
1	5	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	150	1,646	5,358	0.16	0.00	82.8
1	6	T-38C	T38C-DR	DEP	1LD1	100.00 % RPM	0	1,371	6,911	0.51	0.02	82.8
1	7	F-16C	F16C-DJ	DEP	1LD1	93.00 % NC	0	1,371	6,911	0.51	0.02	82.4
1	8	A-10A	A10A-DB	DEP	9RD4	6700.00 NF	160	4,063	5,402	1.19	0.04	81.0
1	9	KC-135R	9RCC	PAT	9RC2	70.00 % NF	145	1,680	4,538	2.35	0.57	80.8
1	10	KC-135R	135B	DEP	9RD4	89.60 % NF	160	2,283	4,634	1.19	0.04	80.6
2	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	2,346	1,015	0.51	0.02	107.5
2	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,397	2,689	0.16	0.00	100.7
2	3	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,677	345	0.37	0.01	98.9
2	4	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,993	657	0.15	0.00	96.3
2	5	KC-135R	9RCB	PAT	9RC1	65.00 % NF	180	1,800	466	4.27	1.21	95.2
2	6	KC-135R	19RAE	ARR	9RA4	70.00 % NF	145	2,007	671	0.25	0.07	94.1
2	7	KC-135R	19RAD	ARR	9RA3	70.00 % NF	145	2,007	671	1.23	0.35	94.1
2	8	KC-135R	19RAB	ARR	9RA1	70.00 % NF	145	2,007	671	0.34	0.09	94.1
2	9	KC-135R	19RAA	ARR	9RA2	70.00 % NF	145	2,007	671	1.05	0.30	94.1
2	10	KC-135R	135C	ARR	9RA2	66.50 % NF	160	1,992	656	1.19	0.04	93.1
3	1	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	240	2,999	4,792	0.16	0.00	94.7
3	2	KC-135R	1RCB	PAT	1RC2	80.00 % NF	170	2,621	1,260	0.13	0.06	89.4
3	3	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	250	1,759	8,316	0.51	0.02	86.9
3	4	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	240	3,000	4,792	0.38	0.00	83.4
3	5	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	2,774	8,426	0.51	0.02	81.5
3	6	B-747-20A	747-D1	DEP	1LD1	34530.00 LBS	153	2,849	8,434	0.07	0.00	80.9
3	7	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	9,081	1.19	0.04	79.3
3	8	KC-135R	9RCC	PAT	9RC2	70.00 % NF	145	1,871	3,978	2.35	0.57	79.0
3	9	KC-135R	9LCB	PAT	9LC2	70.00 % NF	185	2,999	4,793	0.24	0.11	78.4
3	10	KC-135R	135C1	PAT	1RC1	70.00 % NF	180	3,000	4,792	0.33	0.00	77.4
4	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	1,987	4,272	0.51	0.02	94.6
4	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,291	5,297	0.16	0.00	93.6
4	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,181	4,608	0.07	0.00	85.8
4	4	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	3,666	4,848	0.51	0.02	83.5
4	5	KC-135R	135D	DEP	1LD1	89.60 % NF	200	2,371	4,347	0.51	0.02	81.0
4	6	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,840	4,252	0.15	0.00	80.9
4	7	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,773	5,068	0.38	0.00	80.7
4	8	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	9,059	1.19	0.04	80.3
4	9	A-10A	A10A-DA	DEP	1LD1	6700.00 NF	160	4,928	5,679	0.51	0.02	80.2
4	10	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,674	4,235	0.37	0.01	80.0
5	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	250	1,776	3,715	0.51	0.02	96.2
5	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,172	4,595	0.16	0.00	95.9

Table C-1-4. Noise Contributors at Representative Locations Near McConnell AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

McConnell Baseline												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
5	3	B-747-20A	747-D1	DEP	1LD1	34530.00 LBS	153	2,898	4,016	0.07	0.00	88.9
5	4	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	2,874	4,017	0.51	0.02	88.6
5	5	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	150	1,602	4,523	0.38	0.00	84.9
5	6	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	5,569	1.19	0.04	84.5
5	7	A-10A	A10A-DA	DEP	1LD1	6700.00 NF	160	3,744	4,494	0.51	0.02	83.2
5	8	KC-135R	135D	DEP	1LD1	89.60 % NF	160	2,179	3,788	0.51	0.02	82.6
5	9	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,639	3,701	0.15	0.00	81.9
5	10	F-16C	F16C-DK	DEP	9RD4	93.00 % NC	0	1,371	5,569	1.19	0.04	81.0
6	1	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,519	3,686	0.16	0.00	97.6
6	2	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	2,771	3,940	0.51	0.02	95.3
6	3	KC-135R	19LAD	ARR	9LA4	65.00 % NF	160	2,403	1,091	0.02	0.01	89.2
6	4	KC-135R	19LAB	ARR	9LA2	65.00 % NF	160	2,403	1,091	0.11	0.05	89.1
6	5	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,453	4,233	0.07	0.00	84.5
6	6	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	2,174	3,761	0.15	0.00	82.7
6	7	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	2,069	2,931	0.38	0.00	82.4
6	8	KC-135R	9LCB	PAT	9LC2	70.00 % NF	165	2,180	3,085	0.24	0.11	82.3
6	9	KC-135R	135D	DEP	1LD1	89.60 % NF	250	2,398	3,818	0.51	0.02	81.7
6	10	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,680	3,683	0.37	0.01	81.6
7	1	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,528	3,331	0.16	0.00	101.0
7	2	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	1,992	5,488	0.51	0.02	92.0
7	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,182	5,748	0.07	0.00	83.8
7	4	KC-135R	135C1	PAT	1RC1	84.70 % NF	180	2,869	3,300	0.33	0.00	83.2
7	5	KC-135R	9LCB	PAT	9LC2	70.00 % NF	165	2,072	3,616	0.24	0.11	82.3
7	6	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	3,674	5,943	0.51	0.02	81.9
7	7	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,774	4,642	0.38	0.00	81.8
7	8	KC-135R	1RCA	PAT	1RC1	80.00 % NF	200	2,869	3,300	2.73	0.94	81.6
7	9	KC-135R	9RCC	PAT	9RC2	70.00 % NF	145	1,871	3,884	2.35	0.57	79.2
7	10	KC-135R	19LAD	ARR	9LA4	65.00 % NF	145	1,822	4,647	0.02	0.01	79.1
8	1	F-16C	F16C-DK	DEP	9RD4	90.00 % NC	325	2,629	1,884	1.19	0.04	102.4
8	2	F-16C	F16C-CB	PAT	9LC1	92.00 % NC	250	2,456	3,552	0.38	0.00	97.8
8	3	KC-135R	9RCC	PAT	9RC2	70.00 % NF	145	1,870	640	2.35	0.57	95.1
8	4	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	180	2,016	877	0.16	0.00	92.3
8	5	KC-135R	1RAC	ARR	1RA1	70.00 % NF	145	2,116	962	0.29	0.08	91.3
8	6	B-747-20A	747-A1	ARR	1LA3	6340.00 LBS	131	2,114	1,553	0.07	0.00	91.0
8	7	KC-135R	135C1	PAT	1RC1	65.00 % NF	150	2,044	900	0.33	0.00	90.6
8	8	KC-135R	1RCA	PAT	1RC1	65.00 % NF	150	2,044	900	2.73	0.94	90.6
8	9	KC-135R	1RAA	ARR	1RA5	65.00 % NF	160	2,096	945	0.91	0.26	90.2
8	10	B-747-20A	747-D2	DEP	9RD4	23954.00 LBS	181	3,403	2,491	0.15	0.00	89.5

Table C-1-4. Noise Contributors at Representative Locations Near McConnell AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

McConnell FTU												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	F-16C	F16C-DK	DEP	9RD4	90.00 % NC	250	1,811	4,552	1.19	0.04	94.2
1	2	F-16C	F16C-CB	PAT	9LC1	92.00 % NC	250	2,215	5,429	0.38	0.00	93.9
1	3	B-747-20A	747-D2	DEP	9RD4	34530.00 LBS	153	3,001	4,845	0.15	0.00	86.7
1	4	T-38C	T38C-DS	DEP	9RD4	95.00 % RPM	250	3,089	4,889	1.19	0.04	85.9
1	5	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	150	1,646	5,358	0.16	0.00	82.8
1	6	T-38C	T38C-DR	DEP	1LD1	100.00 % RPM	0	1,371	6,911	0.51	0.02	82.8
1	7	F-16C	F16C-DJ	DEP	1LD1	93.00 % NC	0	1,371	6,911	0.51	0.02	82.4
1	8	A-10A	A10A-DB	DEP	9RD4	6700.00 NF	160	4,063	5,402	1.19	0.04	81.0
1	9	KC-135R	9RCC	PAT	9RC2	70.00 % NF	145	1,680	4,538	2.35	0.57	80.8
1	10	KC-135R	135B	DEP	9RD4	89.60 % NF	160	2,283	4,634	1.19	0.04	80.6
2	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	2,346	1,015	0.51	0.02	107.5
2	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,397	2,689	0.16	0.00	100.7
2	3	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,677	345	0.37	0.01	98.9
2	4	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,993	657	0.15	0.00	96.3
2	5	KC-135R	9RCB	PAT	9RC1	65.00 % NF	180	1,800	466	4.27	1.21	95.2
2	6	KC-135R	19RAE	ARR	9RA4	70.00 % NF	145	2,007	671	0.25	0.07	94.1
2	7	KC-135R	19RAD	ARR	9RA3	70.00 % NF	145	2,007	671	1.23	0.35	94.1
2	8	KC-135R	19RAB	ARR	9RA1	70.00 % NF	145	2,007	671	0.34	0.09	94.1
2	9	KC-135R	19RAA	ARR	9RA2	70.00 % NF	145	2,007	671	1.05	0.30	94.1
2	10	KC-135R	135C	ARR	9RA2	66.50 % NF	160	1,992	656	1.19	0.04	93.1
3	1	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	240	2,999	4,792	0.16	0.00	94.7
3	2	KC-135R	1RCB	PAT	1RC2	80.00 % NF	170	2,621	1,260	0.13	0.06	89.4
3	3	KC-46X	46RCD	PAT	1RC3	85.00 % N1	180	2,214	1,510	0.46	0.10	88.5
3	4	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	250	1,759	8,316	0.51	0.02	86.9
3	5	KC-46X	46RCB	PAT	1RC2	85.00 % N1	190	3,131	1,764	2.30	0.50	85.5
3	6	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	240	3,000	4,792	0.38	0.00	83.4
3	7	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	2,774	8,426	0.51	0.02	81.5
3	8	B-747-20A	747-D1	DEP	1LD1	34530.00 LBS	153	2,849	8,434	0.07	0.00	80.9
3	9	KC-46X	46RDM	DEP	1RD4	92.00 % N1	200	3,887	4,827	1.27	1.77	79.7
3	10	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	9,081	1.19	0.04	79.3
4	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	1,987	4,272	0.51	0.02	94.6
4	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,291	5,297	0.16	0.00	93.6
4	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,181	4,608	0.07	0.00	85.8
4	4	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	3,666	4,848	0.51	0.02	83.5
4	5	KC-135R	135D	DEP	1LD1	89.60 % NF	200	2,371	4,347	0.51	0.02	81.0
4	6	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,840	4,252	0.15	0.00	80.9
4	7	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,773	5,068	0.38	0.00	80.7
4	8	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	9,059	1.19	0.04	80.3
4	9	A-10A	A10A-DA	DEP	1LD1	6700.00 NF	160	4,928	5,679	0.51	0.02	80.2
4	10	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,674	4,235	0.37	0.01	80.0

Table C-1-4. Noise Contributors at Representative Locations Near McConnell AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

McConnell FTU												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
5	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	250	1,776	3,715	0.51	0.02	96.2
5	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,172	4,595	0.16	0.00	95.9
5	3	B-747-20A	747-D1	DEP	1LD1	34530.00 LBS	153	2,898	4,016	0.07	0.00	88.9
5	4	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	2,874	4,017	0.51	0.02	88.6
5	5	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	150	1,602	4,523	0.38	0.00	84.9
5	6	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	5,569	1.19	0.04	84.5
5	7	A-10A	A10A-DA	DEP	1LD1	6700.00 NF	160	3,744	4,494	0.51	0.02	83.2
5	8	KC-135R	135D	DEP	1LD1	89.60 % NF	160	2,179	3,788	0.51	0.02	82.6
5	9	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,639	3,701	0.15	0.00	81.9
5	10	F-16C	F16C-DK	DEP	9RD4	93.00 % NC	0	1,371	5,569	1.19	0.04	81.0
6	1	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,519	3,686	0.16	0.00	97.6
6	2	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	2,771	3,940	0.51	0.02	95.3
6	3	KC-135R	19LAD	ARR	9LA4	65.00 % NF	160	2,403	1,091	0.02	0.01	89.2
6	4	KC-135R	19LAB	ARR	9LA2	65.00 % NF	160	2,403	1,091	0.11	0.05	89.1
6	5	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,453	4,233	0.07	0.00	84.5
6	6	KC-46X	46LAM	ARR	9LA2	60.00 % N1	180	2,455	1,148	0.59	0.35	83.2
6	7	KC-46X	46LAK	ARR	9LA4	60.00 % N1	180	2,455	1,148	0.39	0.24	83.2
6	8	KC-46X	46LAH	ARR	9LA6	60.00 % N1	180	2,125	1,164	0.82	0.49	82.8
6	9	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	2,174	3,761	0.15	0.00	82.7
6	10	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	2,069	2,931	0.38	0.00	82.4
7	1	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,528	3,331	0.16	0.00	101.0
7	2	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	1,992	5,488	0.51	0.02	92.0
7	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,182	5,748	0.07	0.00	83.8
7	4	KC-46X	46RDM	DEP	1RD4	92.00 % N1	200	3,814	2,603	1.27	1.77	83.7
7	5	KC-46X	46RCC	PAT	1RC4	90.00 % N1	190	2,959	2,764	0.46	0.10	83.5
7	6	KC-135R	135C1	PAT	1RC1	84.70 % NF	180	2,869	3,300	0.33	0.00	83.2
7	7	KC-135R	9LCB	PAT	9LC2	70.00 % NF	165	2,072	3,616	0.24	0.11	82.3
7	8	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	3,674	5,943	0.51	0.02	81.9
7	9	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,774	4,642	0.38	0.00	81.8
7	10	KC-46X	46RCD	PAT	1RC3	85.00 % N1	180	2,114	3,079	0.46	0.10	81.7
8	1	F-16C	F16C-DK	DEP	9RD4	90.00 % NC	325	2,629	1,884	1.19	0.04	102.4
8	2	F-16C	F16C-CB	PAT	9LC1	92.00 % NC	250	2,456	3,552	0.38	0.00	97.8
8	3	KC-135R	9RCC	PAT	9RC2	70.00 % NF	145	1,870	640	2.35	0.57	95.1
8	4	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	180	2,016	877	0.16	0.00	92.3
8	5	KC-135R	1RAC	ARR	1RA1	70.00 % NF	145	2,116	962	0.29	0.08	91.3
8	6	B-747-20A	747-A1	ARR	1LA3	6340.00 LBS	131	2,114	1,553	0.07	0.00	91.0
8	7	KC-135R	135C1	PAT	1RC1	65.00 % NF	150	2,044	900	0.33	0.00	90.6
8	8	KC-135R	1RCA	PAT	1RC1	65.00 % NF	150	2,044	900	2.73	0.94	90.6
8	9	KC-135R	1RAA	ARR	1RA5	65.00 % NF	160	2,096	945	0.91	0.26	90.2
8	10	B-747-20A	747-D2	DEP	9RD4	23954.00 LBS	181	3,403	2,491	0.15	0.00	89.5

Table C-1-4. Noise Contributors at Representative Locations Near McConnell AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

McConnell MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
1	1	F-16C	F16C-DK	DEP	9RD4	90.00 % NC	250	1,811	4,552	1.19	0.04	94.2
1	2	F-16C	F16C-CB	PAT	9LC1	92.00 % NC	250	2,215	5,429	0.38	0.00	93.9
1	3	B-747-20A	747-D2	DEP	9RD4	34530.00 LBS	153	3,001	4,845	0.15	0.00	86.7
1	4	T-38C	T38C-DS	DEP	9RD4	95.00 % RPM	250	3,089	4,889	1.19	0.04	85.9
1	5	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	150	1,646	5,358	0.16	0.00	82.8
1	6	T-38C	T38C-DR	DEP	1LD1	100.00 % RPM	0	1,371	6,911	0.51	0.02	82.8
1	7	F-16C	F16C-DJ	DEP	1LD1	93.00 % NC	0	1,371	6,911	0.51	0.02	82.4
1	8	A-10A	A10A-DB	DEP	9RD4	6700.00 NF	160	4,063	5,402	1.19	0.04	81.0
1	9	KC-135R	135B	DEP	9RD4	89.60 % NF	160	2,283	4,634	1.19	0.04	80.6
1	10	B-747-20A	747-A1	ARR	1LA3	6340.00 LBS	131	1,694	4,540	0.07	0.00	79.9
2	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	2,346	1,015	0.51	0.02	107.5
2	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,397	2,689	0.16	0.00	100.7
2	3	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,677	345	0.37	0.01	98.9
2	4	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,993	657	0.15	0.00	96.3
2	5	KC-135R	135C	ARR	9RA2	66.50 % NF	160	1,992	656	1.19	0.04	93.1
2	6	C-130H&N&P	130HAA	ARR	9RA2	650.00 C TIT	110	1,991	655	0.37	0.01	92.9
2	7	KC-135R	135D	DEP	1LD1	89.60 % NF	200	2,371	1,032	0.51	0.02	92.8
2	8	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,908	934	0.38	0.00	91.8
2	9	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,305	1,967	0.07	0.00	91.4
2	10	T-38C	T38C	ARR	9RA2	88.00 % RPM	160	1,992	656	1.19	0.04	90.8
3	1	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	240	2,999	4,792	0.16	0.00	94.7
3	2	KC-46X	46RCD	PAT	1RC3	85.00 % N1	180	2,214	1,510	2.59	0.29	88.5
3	3	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	250	1,759	8,316	0.51	0.02	86.9
3	4	KC-46X	46RCB	PAT	1RC2	85.00 % N1	190	3,131	1,764	5.18	0.58	85.5
3	5	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	240	3,000	4,792	0.38	0.00	83.4
3	6	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	2,774	8,426	0.51	0.02	81.5
3	7	B-747-20A	747-D1	DEP	1LD1	34530.00 LBS	153	2,849	8,434	0.07	0.00	80.9
3	8	KC-46X	46RDM	DEP	1RD4	92.00 % N1	200	3,887	4,827	0.56	0.00	79.7
3	9	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	9,081	1.19	0.04	79.3
3	10	KC-135R	135C1	PAT	1RC1	70.00 % NF	180	3,000	4,792	0.33	0.00	77.4
4	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	1,987	4,272	0.51	0.02	94.6
4	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,291	5,297	0.16	0.00	93.6
4	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,181	4,608	0.07	0.00	85.8
4	4	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	3,666	4,848	0.51	0.02	83.5
4	5	KC-135R	135D	DEP	1LD1	89.60 % NF	200	2,371	4,347	0.51	0.02	81.0
4	6	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,840	4,252	0.15	0.00	80.9
4	7	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,773	5,068	0.38	0.00	80.7
4	8	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	9,059	1.19	0.04	80.3
4	9	A-10A	A10A-DA	DEP	1LD1	6700.00 NF	160	4,928	5,679	0.51	0.02	80.2
4	10	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,674	4,235	0.37	0.01	80.0
5	1	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	250	1,776	3,715	0.51	0.02	96.2
5	2	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,172	4,595	0.16	0.00	95.9

Table C-1-4. Noise Contributors at Representative Locations Near McConnell AFB Under Baseline, FTU and MOB 1 Scenarios (Continued)

McConnell MOB 1												
Point	Rank	Aircraft	Profile	Op Type	Track	Engine Power	Airspeed (KIAS)	Altitude (ft MSL)	Slant Distance (ft)	Operations		SEL (dB)
										Day	Night	
5	3	B-747-20A	747-D1	DEP	1LD1	34530.00 LBS	153	2,898	4,016	0.07	0.00	88.9
5	4	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	2,874	4,017	0.51	0.02	88.6
5	5	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	150	1,602	4,523	0.38	0.00	84.9
5	6	T-38C	T38C-DS	DEP	9RD4	100.00 % RPM	0	1,371	5,569	1.19	0.04	84.5
5	7	A-10A	A10A-DA	DEP	1LD1	6700.00 NF	160	3,744	4,494	0.51	0.02	83.2
5	8	KC-135R	135D	DEP	1LD1	89.60 % NF	160	2,179	3,788	0.51	0.02	82.6
5	9	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	1,639	3,701	0.15	0.00	81.9
5	10	F-16C	F16C-DK	DEP	9RD4	93.00 % NC	0	1,371	5,569	1.19	0.04	81.0
6	1	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,519	3,686	0.16	0.00	97.6
6	2	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	2,771	3,940	0.51	0.02	95.3
6	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,453	4,233	0.07	0.00	84.5
6	4	KC-46X	46LAH	ARR	9LA6	60.00 % N1	160	2,229	119	0.59	0.07	84.2
6	5	KC-46X	46LAM	ARR	9LA2	60.00 % N1	180	2,455	1,148	0.43	0.05	83.2
6	6	KC-46X	46LAK	ARR	9LA4	60.00 % N1	180	2,455	1,148	0.28	0.03	83.2
6	7	B-747-20A	747-A2	ARR	9RA2	6340.00 LBS	131	2,174	3,761	0.15	0.00	82.7
6	8	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	2,069	2,931	0.38	0.00	82.4
6	9	KC-135R	135D	DEP	1LD1	89.60 % NF	250	2,398	3,818	0.51	0.02	81.7
6	10	SK70 (UH-60A) BLACKH	HELC-AB	ARR	9RA2	150.00 KNOTS	150	1,680	3,683	0.37	0.01	81.6
7	1	F-16C	F16C-CA	PAT	1RC1	92.00 % NC	250	2,528	3,331	0.16	0.00	101.0
7	2	F-16C	F16C-DJ	DEP	1LD1	90.00 % NC	325	1,992	5,488	0.51	0.02	92.0
7	3	B-747-20A	747-D1	DEP	1LD1	23954.00 LBS	181	3,182	5,748	0.07	0.00	83.8
7	4	KC-46X	46RDM	DEP	1RD4	92.00 % N1	200	3,814	2,603	0.56	0.00	83.7
7	5	KC-135R	135C1	PAT	1RC1	84.70 % NF	180	2,869	3,300	0.33	0.00	83.2
7	6	T-38C	T38C-DR	DEP	1LD1	95.00 % RPM	250	3,674	5,943	0.51	0.02	81.9
7	7	KC-46X	46RCC	PAT	1RC4	85.00 % N1	190	2,959	2,764	2.59	0.29	81.9
7	8	F-16C	F16C-CB	PAT	9LC1	83.00 % NC	180	1,774	4,642	0.38	0.00	81.8
7	9	KC-46X	46RCD	PAT	1RC3	85.00 % N1	180	2,114	3,079	2.59	0.29	81.7
7	10	KC-46X	46RCA	PAT	1RC1	85.00 % N1	190	2,953	3,332	6.91	0.77	79.7
8	1	F-16C	F16C-DK	DEP	9RD4	90.00 % NC	325	2,629	1,884	1.19	0.04	102.4
8	2	F-16C	F16C-CB	PAT	9LC1	92.00 % NC	250	2,456	3,552	0.38	0.00	97.8
8	3	F-16C	F16C-CA	PAT	1RC1	83.00 % NC	180	2,016	877	0.16	0.00	92.3
8	4	B-747-20A	747-A1	ARR	1LA3	6340.00 LBS	131	2,114	1,553	0.07	0.00	91.0
8	5	KC-135R	135C1	PAT	1RC1	65.00 % NF	150	2,044	900	0.33	0.00	90.6
8	6	B-747-20A	747-D2	DEP	9RD4	23954.00 LBS	181	3,403	2,491	0.15	0.00	89.5
8	7	SK70 (UH-60A) BLACKH	HELA-AA	ARR	1LA3	150.00 KNOTS	150	1,679	1,372	0.16	0.01	89.4
8	8	KC-46X	46RCG	PAT	9RC2	60.00 % N1	150	1,725	659	0.17	0.02	89.1
8	9	KC-135R	135B	DEP	9RD4	89.60 % NF	200	2,371	1,702	1.19	0.04	88.6
8	10	KC-46X	46RDE	DEP	9LD2	92.00 % N1	185	2,894	1,685	0.85	0.01	87.6

Key: ARR = Arrival; DEP = Departure; PAT = Closed Pattern.
Power Units: LBS = pounds of thrust; N1 = engine speed at Location No. 1; NC = core engine speed; NF = engine fan revolutions per minute; RPM = revolutions per minute.
Source: NOISEMAP Version 7.2.

APPENDIX D

AIR QUALITY BACKGROUND INFORMATION AND EMISSION CALCULATIONS

This Appendix is contained on the CD-ROM on the back cover of this document.

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APPENDIX D AIR QUALITY BACKGROUND INFORMATION AND EMISSION CALCULATIONS

This appendix includes air quality background information for each of the four bases under consideration for the KC-46A Formal Training Unit (FTU) and First Main Operating Base (MOB 1) missions. This background information includes the regional climate information, along with the spreadsheets that were used to complete the air quality analysis contained in Volume I, Chapter 4 (see Sections 4.1.2, 4.2.2, 4.3.2, and 4.4.2).

D.1 ALTUS AIR FORCE BASE REGIONAL CLIMATE

Altus, Oklahoma, has a continental climate, characterized by pronounced variations in daily and seasonal temperatures and seasonal and annual precipitation. Meteorological data collected at Altus, Oklahoma, are used to describe the climate of the Altus Air Force Base (AFB) project area (OCS 2013a, 2013b).

Temperature. Jackson County is known for high temperatures in the summer months and cool conditions during the winter. The average high and low temperatures during the summer months at Altus AFB range from about 98 degrees Fahrenheit (°F) to 66 °F. The average high and low temperatures during the winter months range from 53 °F to 26 °F (OCS 2013a).

Precipitation. Average annual precipitation for Altus AFB is 28.8 inches. Precipitation is greatest during the warmer months of the year, and the peak monthly average of 4.8 inches occurs in May. Precipitation is at a minimum during the winter, as the lowest monthly average of 1.0 inch occurs in January. Snow is not uncommon during winter, but the average annual snowfall is only 3.0 inches (OCS 2013a).

Prevailing Winds. Altus AFB experiences fairly breezy conditions, as the average wind speed for each month of the year is at least 8.5 miles per hour and the annual average wind speed is 10.5 miles per hour. Spring is generally the windiest season, as the peak average monthly winds of 12.9 miles per hour occur in April. The wind prevails from the southeast direction for most of the year, but shifts to the northwest to north-northeast during the winter months (OCS 2013b).

D.1.1 OPERATIONS EMISSION CALCULATIONS FOR THE KC-46A PROJECT SCENARIOS AT ALTUS AFB

Table D.1-1. Engine Emission Factors by Throttle Setting – KC-135, C-17, and KC-46A Aircraft

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel) [a]									
		VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
CFM56-2B-1 [b]											
Idle	1,014	2.10	30.70	4.00	1.06	0.06	0.06	3,216	0.09	0.10	3,249
Approach	2,463	0.09	4.20	8.20	1.06	0.06	0.06	3,216	0.09	0.10	3,249
Climbout	6,486	0.06	0.09	16.00	1.06	0.05	0.05	3,216	0.09	0.10	3,249
Take-off	7,801	0.05	0.09	18.50	1.06	0.07	0.07	3,216	0.09	0.10	3,249
F117-PW-100 [c]											
Idle	978	–	–	–	–	–	–	3,216	0.09	0.10	3,249
Approach	4,645	–	–	–	–	–	–	3,216	0.09	0.10	3,249
Intermediate	10,408	–	–	–	–	–	–	3,216	0.09	0.10	3,249
Military	14,111	–	–	–	–	–	–	3,216	0.09	0.10	3,249
P&W 4062 [d]											
Idle	1,663	12.49	42.61	3.78	1.06	0.11	0.10	3,216	0.09	0.10	3,249
Approach	5,702	0.10	1.93	12.17	1.06	0.05	0.04	3,216	0.09	0.10	3,249
Climbout	16,870	0.08	0.50	25.98	1.06	0.07	0.06	3,216	0.09	0.10	3,249
Take-off	21,622	0.09	0.61	34.36	1.06	0.08	0.07	3,216	0.09	0.10	3,249
55%	10,778	0.09	1.28	18.45	1.06	0.06	0.05	3,216	0.09	0.10	3,249
60%	11,794	0.09	1.15	19.70	1.06	0.06	0.05	3,216	0.09	0.10	3,249

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel) [a]									
		Acetalde-hyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Dibutyl Phthalate	1,2-Dichloro-propane
CFM56-2B-1 [b]											
Idle	1,014	–	–	0.0019	–	–	–	0.0023	0.0009	–	–
Approach	2,463	–	–	0.0032	–	–	0.0005	0.0019	0.0009	–	–
Climbout	6,486	–	–	0.0004	–	–	0.0004	0.0018	0.0008	–	–
Take-off	7,801	–	–	0.0011	–	–	–	0.0012	0.0003	–	–
F117-PW-100 [c]											
Idle	978	0.012	–	0.0225	–	–	–	0.0012	–	0.0007	0.0022
Approach	4,645	–	–	0.0009	–	–	–	0.0012	0.0004	0.0008	0.0016
Intermediate	10,408	–	–	0.0006	–	0.0004	–	0.0006	–	0.0002	0.0006
Military	14,111	–	–	0.0006	–	0.0004	–	0.0006	–	0.0002	0.0006
P&W 4062 [d]											
Idle	1,663	0.538	0.309	0.212	0.213	–	–	–	–	–	–
Approach	5,702	0.004	0.003	0.002	0.002	–	–	–	–	–	–
Climbout	16,870	0.003	0.002	0.001	0.001	–	–	–	–	–	–
Take-off	21,622	0.004	0.002	0.002	0.002	–	–	–	–	–	–
55%	10,778	0.004	0.002	0.002	0.002	–	–	–	–	–	–
60%	11,794	0.004	0.002	0.002	0.002	–	–	–	–	–	–

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel) [a]									
		2,4-Dinitro-phenol	Di(2-Ethylhexyl) Phthalate (DEHP)	Ethyl-benzene	Formalde-hyde	Hexane	Methanol	Methylene Chloride	Methyl tert-Butyl Ether (MTBE)	Naphth-alene	Phenol
CFM56-2B-1 [b]						NR only			NR only		
Idle	1,014	–	0.0055	0.0007	0.0951	–	–	0.0675	–	0.0029	–
Approach	2,463	–	0.0015	0.0006	0.0150	–	–	0.0446	–	–	–
Climbout	6,486	–	0.0045	–	0.0056	–	–	0.0506	–	–	–
Take-off	7,801	–	0.0020	–	0.0070	–	–	0.0020	–	–	–
F117-PW-100 [c]											
Idle	978	0.0074	0.0030	0.0028	0.2360	–	–	0.0008	–	0.0024	0.0038
Approach	4,645	0.0056	0.0019	–	0.0165	–	–	–	–	–	–
Intermediate	10,408	0.0036	0.0017	–	0.0095	–	–	0.0063	–	–	–
Military	14,111	0.0036	0.0017	–	0.0095	–	–	0.0063	–	–	–
P&W 4062 [d]											
Idle	1,663	–	–	0.022	1.551	–	0.227	–	–	0.068	0.091
Approach	5,702	–	–	0.000	0.013	–	0.002	–	–	0.001	0.001
Climbout	16,870	–	–	0.000	0.010	–	0.001	–	–	0.000	0.001
Take-off	21,622	–	–	0.000	0.011	–	0.002	–	–	0.001	0.001
55%	10,778	–	–	0.000	0.012	–	0.002	–	–	0.001	0.001
60%	11,794	–	–	0.000	0.011	–	0.002	–	–	0.000	0.001

Table D.1-1. Engine Emission Factors by Throttle Setting – KC-135, C-17, and KC-46A Aircraft (Continued)

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel) [a]									
		POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
CFM56-2B-1 [b]		NR only	NR only								
Idle	1,014	–	–	0.0015	–	0.0019	0.0090	0.0008	0.0049	0.0017	–
Approach	2,463	–	–	–	–	0.0032	0.0062	0.0008	0.0038	0.0016	–
Climbout	6,486	–	–	–	–	0.0004	0.0014	–	0.0025	0.0005	–
Take-off	7,801	–	–	–	–	0.0011	0.0011	0.0003	0.0024	0.0003	–
F117-PW-100 [c]											
Idle	978	–	–	0.0016	0.0033	–	0.0067	–	–	0.0023	0.0010
Approach	4,645	–	–	–	0.0019	–	0.0014	0.0004	–	0.0006	–
Intermediate	10,408	–	–	–	0.0010	–	0.0011	–	–	0.0005	–
Military	14,111	–	–	–	0.0010	–	0.0011	–	–	0.0005	–
P&W 4062 [d]											
Idle	1,663	–	–	0.039	–	–	0.081	–	–	0.036	0.021
Approach	5,702	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Climbout	16,870	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Take-off	21,622	–	–	0.000	–	–	0.001	–	–	0.000	0.000
55%	10,778	–	–	0.000	–	–	0.001	–	–	0.000	0.000
60%	11,794	–	–	0.000	–	–	0.001	–	–	0.000	0.000

[a] Data are for 1 engine. The KC-135/KC-46A have 4/2 engines. VOC data estimated by multiplying THC source test data by 1.15 (USEPA and FAA 2009).

[b] Criteria pollutant data from ICAO Engine Exhaust Emissions Data Bank – Subsonic Engines – ENGINE IDENTIFICATION: CFM56-2B-1 (ICAO 1987). HAPs data from AFCEC 2013.

[c] From AFCEC 2013. For HAPs data, intermediate mode used to simulate military mode.

[d] ICAO Engine Exhaust Emissions Data Bank – Subsonic Engines – ENGINE IDENTIFICATION: PW4062 (ICAO 2013). HAPs data from Boeing 2013b.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, N_2O = nitrous oxide, NO_x = nitrogen oxides, P&W = Pratt & Whitney, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-2. Land and Take-off/Touch and Go Times in Modes and Fuel Usages – KC-135 and KC-46A Aircraft

Aircraft/Mode (Engine Throttle Setting)	Land and Take-Off			Touch and Go	
	Time in Mode (TIM)		*Fuel Usage*	*TIM*	*Fuel Usage*
	(Minutes)	*(Hours)*	*(Pounds)* [a]	*(Hours)*	*(Pounds)* [a]
KC-135 [b]					
Taxi Out (Idle)	32.8	0.55	2,217	–	–
Take-off (Military)	0.7	0.01	364	0.01	364
Climbout (Intermediate)	1.6	0.03	692	0.03	692
Approach	5.2	0.09	854	0.09	854
Taxi In (Idle)	14.9	0.25	1,007		
Totals	**55.2**	**0.92**	**5,134**	**0.13**	**1,910**
KC-46A [b]					
Taxi Out (Idle)	32.8	0.55	1,818	–	–
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	1.6	0.03	900	0.03	900
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826	–	–
Totals	**55.2**	**0.92**	**5,037**	**0.13**	**2,393**

[a] Fuel usage per aircraft.

[b] TIM data from Table C-2-4 (AFCEC 2013).

Key: – = Source does not emit particular pollutant.

Table D.1-3. Land and Take-off/Touch and Go Total Fuel Usages and Emissions – KC-135 and KC-46A Aircraft

Aircraft/ Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Land and Take-Off											
KC-135	5,134	6.92	102.65	37.70	5.44	0.30	0.30	16,510	0.46	0.51	16,678
KC-46A	5,037	33.25	115.35	62.73	5.34	0.44	0.39	16,199	0.45	0.50	16,365
Touch and Go											
KC-135	1,910	0.14	3.68	24.81	2.02	0.11	0.11	6,142	0.17	0.19	6,205
KC-46A	2,393	0.22	2.67	52.74	2.54	0.15	0.13	7,695	0.21	0.24	7,773

Aircraft/ Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		Acetalde-hyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Dibutyl Phthalate	1,2-Dichloro-propane
Land and Take-Off											
KC-135	5,134	–	–	0.010	–	–	0.001	0.011	0.004	–	–
KC-46A	5,037	1.433	0.821	0.564	0.566	–	–	–	–	–	–
Touch and Go											
KC-135	1,910	–	–	0.003	–	–	0.001	0.003	0.001	–	–
KC-46A	2,393	0.010	0.005	0.004	0.004	–	–	–	–	–	–

Aircraft/ Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		2,4-Dinitro-phenol	DEHP	Ethyl-benzene	Formald-ehyde	Hexane	Methanol	Methylene-Chloride	MTBE	Naphtha-lene	Phenol
Land and Take-Off											
KC-135	5,134	–	0.023	0.003	0.326	–	–	0.291	–	0.009	–
KC-46A	5,037	–	–	0.058	4.128	–	0.605	–	–	0.181	0.244
Touch and Go											
KC-135	1,910	–	0.005	0.000	0.019	–	–	0.074	–	–	–
KC-46A	2,393	–	–	0.000	0.027	–	0.004	–	–	0.001	0.002

Aircraft/ Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		POM	Propio-nalde-hyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetra-chloro-ethene	Toluene	1,1,1-Trichloro-ethane	Vinyl Acetate	mp-Xylene	o-Xylene
Land and Take-Off											
KC-135	5,134	–	–	0.005	–	0.010	0.036	0.003	0.022	0.007	–
KC-46A	5,037	–	–	0.104	–	–	0.215	–	–	0.095	0.056
Touch and Go											
KC-135	1,910	–	–	–	–	0.003	0.007	0.001	0.006	0.002	–
KC-46A	2,393	–	–	0.001	–	–	0.001	–	–	0.001	0.000

Key: – = No activity, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-4. Annual Hours of Aircraft Operation by Engine Setting for Altus AFB – Year 2008

Aircraft	Engine Setting/Hours				
	Idle	*Approach*	*Intermediate*	*Takeoff*	*Total*
C-17	54,227	18,077	9,305	2,433	**84,042**
KC-135	21,313	17,757	10,212	2,390	**51,672**

Source: 2008 Mobile Source Air Emissions Inventory for Altus Air Force Base (Weston Solutions, Inc. 2008).

Table D.1-4a. Annual Fuel Usages for Aircraft at Altus AFB –Year 2008

Aircraft	Annual Pounds of Fuel Usage/1,000 Pounds				
	Idle	*Approach*	*Intermediate*	*Takeoff*	*Total*
C-17	53,034	83,968	96,846	34,332	**268,180**
KC-135	21,606	43,738	66,240	18,645	**150,229**
Transient	–	–	–	–	**–**

Key: – = No activity.
Source: 2008 Mobile Source Air Emissions Inventory for Altus Air Force Base (Weston Solutions, Inc. 2008).

Table D.1-5. Annual Air Operations for Aircraft at Altus AFB – Year 2008

Aircraft	Number of Operations				
	LTO	*TGO*	*LFB*	*LFP*	Total
C-17	17,052	35,092	–	35,092	**87,236**
KC-135	6,702	44,520	–	44,520	**95,742**
Transient	195	–	–	–	**195**

Key: – = No activity, LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: 2008 Mobile Source Air Emissions Inventory for Altus Air Force Base (Weston Solutions, Inc. 2008).

Table D.1-6. Annual Air Operations for Aircraft at Altus AFB – Year 2012 Existing Conditions

Aircraft	*Number of Operations*				
	LTO	*TGO*	*LFB*	*LFP*	*Total*
C-17	5,038	–	–	20,734	**25,771**
KC-135	1,980	–	–	26,304	**28,284**
Transient	341	–	–	334	**675**

Key: – = No activity, LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: EIS Table 2-5.

Table D.1-7. Comparison of Annual Aircraft LTOs at Altus AFB – 2008 and 2012

Scenario	*Total LTOs*			*Fraction of 2008 LTOs* [a]		
	C-17	*KC-135*	*Transient*	*C-17*	*KC-135*	*Transient*
2008	17,052	6,702	195	–	–	–
2012 Existing Conditions	5,038	1,980	341	0.30	0.30	1.75

[a] Applied to existing aircraft emissions to estimate future emissions from these sources.
Key: – = No activity, LTO = landing and takeoff.

Table D.1-8. Year 2008 AGE Usages – Altus AFB

Source	Fuel Type	Hp	Hrs/Yr	Load Factor	Annual Hp-Hrs	Average Hp
Manlift	JP-8	12.5	80	46	460	0.02
Universal Maint. Stand	JP-8	20.0	480	51	4,896	0.16
Jacking Manifold	JP-8	24.0	85	51	1,040	0.03
Hydraulic Test Stand	JP-8	195.0	53	51	5,271	0.17
Turbine Compressors	JP-8	200.0	170	100	34,000	0.56
Compressors	JP-8	9.5	137	60	781	0.02
Nitrogen Carts	JP-8	49.0	574	51	14,344	0.47
Air Conditioners	JP-8	7.9	6,496	28	14,369	0.85
FL-1D Light Carts	JP-8	10.2	1,244	74	9,390	0.21
Generators	JP-8	148.0	17,471	74	1,913,424	42.88
Generators	JP-8	180.0	14,000	74	1,864,800	41.79
Generators	JP-8	155.0	6,000	74	688,200	15.42
Engine	JP-8	6.0	5,164	51	15,802	0.51
Burner	JP-8	3.1	8,353	62	16,054	0.43
Totals	NA	NA	**60,307**	NA	**4,582,832**	**104**

Key: AGE = aerospace ground operations, Hp = horsepower, Hr = hour, Yr = year.
Source: (Weston Solutions, Inc. 2008).

Table D.1-9. Annual Average Nonroad Emission Factors – Altus AFB KC-46A Scenarios

HP Category/ Fuel Type	Emission Factors (Grams/Horsepower) [a]								
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*
Year 2008									
Diesel	1.13	3.03	14.06	0.93	1.00	1.00	568	0.094	0.007
Year 2012									
100-175 HP Diesel	0.54	3.92	4.58	0.13	0.61	0.56	608	0.094	0.007
Year 2016 FTU or MOB 1									
100-175 HP Diesel	0.38	2.75	3.11	0.12	0.46	0.42	608	0.094	0.007

[a] Year 2008 data from 2008 AEI (Weston Solutions, Inc. 2008) and assumes uncontrolled factors. Year 2012/2016 factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Jackson County, Oklahoma.

Key: AEI = Air Emissions Inventory, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HP = horsepower, MOB 1 = First Main Operating Base, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-10. Annual Air Emissions for KC-135 Aircraft Operations – Altus AFB Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Year 2008										
C-17 Aircraft Operations	87.74	794.00	2,745.60	232.00	686.68	686.68	425,379	11.77	13.23	429,726
KC-135 Aircraft Operations	13.10	525.00	713.00	121.00	176.00	176.00	221,857	6.14	6.90	224,125
Transient Aircraft Operations	0.79	2.90	1.80	0.18	0.44	0.44	330	0.01	0.01	333
On-Wing Aircraft Engine Testing - C-17	10.90	120.00	35.40	9.40	54.10	54.10	17,235	0.48	0.54	17,411
On-Wing Aircraft Engine Testing - KC-135	4.30	126.00	25.20	8.70	42.50	42.50	15,952	0.44	0.50	16,115
Aerospace Ground Support Equipment	5.70	15.30	71.00	4.70	5.04	5.00	15,753	2.61	0.19	15,865
Subtotal - Year 2008	**122.53**	**1,583.20**	**3,592.00**	**375.98**	**964.76**	**964.72**	**696,505**	**21.45**	**21.35**	**703,575**
Year 2012										
C-17 Aircraft Operations	25.92	234.56	811.10	68.54	202.86	202.86	125,665	3.48	3.91	126,950
KC-135 Aircraft Operations	3.87	155.10	210.64	35.75	52.00	52.00	65,544	1.81	2.04	66,214
Transient Aircraft Operations	1.38	5.07	3.15	0.31	0.77	0.77	577	0.02	0.02	583
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [a]	0.84	6.08	7.11	0.20	0.94	0.86	5,181	0.80	0.06	5,215
Subtotal - Year 2012	**32.01**	**400.82**	**1,032.00**	**104.80**	**256.57**	**256.49**	**196,967**	**6.11**	**6.02**	**198,962**
FTU or MOB 1 Scenario										
C-17 Aircraft Operations	25.92	234.56	811.10	68.54	202.86	202.86	125,665	3.48	3.91	126,950
KC-135 Aircraft Operations	3.87	155.10	210.64	35.75	52.00	52.00	65,544	1.81	2.04	66,214
Transient Aircraft Operations	1.38	5.07	3.15	0.31	0.77	0.77	577	0.02	0.02	583
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [b]	0.59	4.27	4.83	0.19	0.71	0.65	5,181	0.80	0.06	5,215
Subtotal - FTU Scenario	**31.76**	**399.00**	**1,029.72**	**104.79**	**256.34**	**256.27**	**196,968**	**6.11**	**6.02**	**198,962**

Scenario/Source	Annual Emissions - Tons									
	Acetalde-hyde	Acrolein	Benzene	1,3-Butad-iene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Dibutyl Phthalate	1,2-Dichloro-propane
Year 2008										
C-17 Aircraft Operations	0.318	–	0.675	–	0.025	–	0.122	0.018	0.067	0.167
KC-135 Aircraft Operations	–	–	0.170	–	–	0.020	0.264	0.107	–	–
Transient Aircraft Operations	0.002	0.002	0.003	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.040	–	0.084	–	0.003	–	0.015	0.002	0.008	0.021
On-Wing Aircraft Engine Testing - KC-135	0.040	–	0.084	–	0.003	–	0.015	0.002	0.008	0.021
Aerospace Ground Support Equipment	0.014	0.002	0.060	0.009	–	–	–	–	–	–
Subtotal - Year 2008	**0.413**	**0.004**	**1.076**	**0.009**	**0.031**	**0.020**	**0.416**	**0.129**	**0.084**	**0.209**
Year 2012										
C-17 Aircraft Operations	0.094	–	0.199	–	0.007	–	0.036	0.005	0.020	0.049
KC-135 Aircraft Operations	–	–	0.050	–	–	0.006	0.078	0.032	–	–
Transient Aircraft Operations	0.003	0.004	0.006	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [a]	0.002	0.000	0.009	0.001	–	–	–	–	–	–
Subtotal - Year 2012	**0.099**	**0.004**	**0.264**	**0.001**	**0.007**	**0.006**	**0.114**	**0.037**	**0.020**	**0.049**
FTU or MOB 1 Scenario										
C-17 Aircraft Operations	0.094	–	0.199	–	0.007	–	0.036	0.005	0.020	0.049
KC-135 Aircraft Operations	–	–	0.050	–	–	0.006	0.078	0.032	–	–
Transient Aircraft Operations	0.003	0.004	0.006	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [b]	0.001	0.000	0.006	0.001	–	–	–	–	–	–
Subtotal - FTU Scenario	**0.099**	**0.004**	**0.262**	**0.001**	**0.007**	**0.006**	**0.114**	**0.037**	**0.020**	**0.049**

Table D.1-10. Annual Air Emissions for KC-135 Aircraft Operations – Altus AFB Scenarios (Continued)

Scenario/Source	Annual Emissions - Tons									
	2,4-Dinitro-phenol	DEHP	Ethyl-benzene	Formalde-hyde	Hexane	Methanol	Methyl-ene Chloride	MTBE	Naphth-alene	Phenol
Year 2008										
C-17 Aircraft Operations	0.665	0.270	0.075	7.574	–	–	0.430	–	0.063	0.100
KC-135 Aircraft Operations	–	0.631	0.047	6.905	–	–	7.108	–	0.199	–
Transient Aircraft Operations	–	–	0.000	0.012	–	–	–	–	0.001	–
On-Wing Aircraft Engine Testing - C-17	0.083	0.034	0.009	0.941	–	–	0.053	–	0.008	0.012
On-Wing Aircraft Engine Testing - KC-135	0.083	0.034	0.009	0.941	–	–	0.053	–	0.008	0.012
Aerospace Ground Support Equipment	–	–	0.018	0.027	0.009	–	–	0.140	0.001	–
Subtotal - Year 2008	**0.831**	**0.967**	**0.159**	**16.400**	**0.009**	**–**	**7.645**	**0.140**	**0.280**	**0.125**
Year 2012										
C-17 Aircraft Operations	0.197	0.080	0.022	2.237	–	–	0.127	–	0.019	0.030
KC-135 Aircraft Operations	–	0.186	0.014	2.040	–	–	2.100	–	0.059	–
Transient Aircraft Operations	–	–	0.001	0.021	–	–	–	–	0.002	–
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [a]	–	–	0.003	0.004	0.001	–	–	0.021	0.000	–
Subtotal - Year 2012	**0.197**	**0.266**	**0.039**	**4.302**	**0.001**	**–**	**2.227**	**0.021**	**0.079**	**0.030**
FTU or MOB 1 Scenario										
C-17 Aircraft Operations	0.197	0.080	0.022	2.237	–	–	0.127	–	0.019	0.030
KC-135 Aircraft Operations	–	0.186	0.014	2.040	–	–	2.100	–	0.059	–
Transient Aircraft Operations	–	–	0.001	0.021	–	–	–	–	0.002	–
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [b]	–	–	0.002	0.003	0.001	–	–	0.014	0.000	–
Subtotal - FTU Scenario	**0.197**	**0.266**	**0.038**	**4.301**	**0.001**	**–**	**2.227**	**0.014**	**0.079**	**0.030**

Scenario/Source	Annual Emissions - Tons									
	POM	Propional-dehyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetra-chloro-ethene	Toluene	1,1,1-Trichloro-ethane	Vinyl Acetate	mp-Xylene	o-Xylene
Year 2008										
C-17 Aircraft Operations	–	–	0.041	0.232	–	0.310	0.016	–	0.123	0.026
KC-135 Aircraft Operations	–	–	0.101	–	0.170	0.702	0.058	0.497	0.145	–
Transient Aircraft Operations	–	–	0.001	–	–	0.002	–	–	–	0.001
On-Wing Aircraft Engine Testing - C-17	–	–	0.005	0.029	–	0.038	0.002	–	0.015	0.003
On-Wing Aircraft Engine Testing - KC-135	–	–	0.005	0.029	–	0.038	0.002	–	0.015	0.003
Aerospace Ground Support Equipment	0.002	0.002	0.001	–	–	0.070	–	–	–	0.065
Subtotal - Year 2008	**0.002**	**0.002**	**0.154**	**0.290**	**0.170**	**1.161**	**0.078**	**0.497**	**0.298**	**0.099**
Year 2012										
C-17 Aircraft Operations	–	–	0.012	0.069	–	0.092	0.005	–	0.036	0.008
KC-135 Aircraft Operations	–	–	0.030	–	0.050	0.207	0.017	0.147	0.043	–
Transient Aircraft Operations	–	–	0.001	–	–	0.003	–	–	–	0.002
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [a]	0.000	0.000	0.000	–	–	0.010	–	–	–	0.010
Subtotal - Year 2012	**0.000**	**0.000**	**0.043**	**0.069**	**0.050**	**0.312**	**0.022**	**0.147**	**0.079**	**0.019**
FTU or MOB 1 Scenario										
C-17 Aircraft Operations	–	–	0.012	0.069	–	0.092	0.005	-	0.036	0.008
KC-135 Aircraft Operations	–	–	0.030	–	0.050	0.207	0.017	0.147	0.043	–
Transient Aircraft Operations	–	–	0.001	–	–	0.003	–	–	–	0.002
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	–	–	–	–	–
Aerospace Ground Support Equipment [b]	0.000	0.000	0.000	–	–	0.007	–	–	–	0.007
Subtotal - FTU Scenario	**0.000**	**0.000**	**0.043**	**0.069**	**0.050**	**0.309**	**0.022**	**0.147**	**0.079**	**0.016**

[a] = 2008 AGE emissions * 2012 total LTOs / 2008 total LTOs * 2012/2008 Nonroad EFs.

[b] = 2012 AGE emissions * 2016/2012 Nonroad EFs.

Key: – = = No activity, AGE = aerospace ground equipment, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EF = emission factors, FTU = Formal Training Unit, Hp = horsepower, LTO = landing and takeoff, MOB 1 = First Main Operating Base, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-11. Existing Aircraft On-Wing Engine Testing Activity Data for Altus AFB – Year 2012

Aircraft/Test Type	Tests/ Year	# of Engines	Duration (Minutes)	Engine Setting/Annual Engine Hours			
				Idle	*Approach*	*Intermediate*	*Takeoff*
C-17 [a]							
Leak Checks	416	1	30	208.0	–	–	–
System Component Checks	520	1	5	43.3	–	–	–
Hydraulic Systems Checks	48	1	7	5.6	–	–	–
Starter Ops Checks	12	1	25	5.0	–	–	–
Engine Replacements	8	1	30	4.0	–	–	–
Engine De-Ice	24	2	17	12.0	1.6	–	–
Stall Check	26	2	31	23.5	1.7		1.9
Electrical Systems Check	312	2	18	145.6	–	41.6	–
Electrical Systems Check	312	4	6	114.4	–	–	–
Oil & Fuel Pressure Check	12	2	22	6.0	–	0.8	2.0
Pressurization Malfunction Checks	6	2	45	3.0	6.0	–	–
Leak Checks for ISO	52	4	30	104.0	–	–	–
Water Washes	26	4	10	17.3	–	–	–
Total Time in Modes (TIMs) - C-17				**692**	**9**	**42**	**4**
KC-135 [a]							
Leak Checks/Troubleshooting	250	1	15	62.4	–	–	–
Leak Checks/Troubleshooting	62	2	15	31.2	–	–	–
Leak Checks/Troubleshooting	312	4	15	312.0	–	–	–
Fuel Transfer	187	1	40	124.8	–	–	–
Fuel Transfer	21	2	40	27.7	–	–	–
Troubleshooting - High Power	104	2	40	69.3	17.3	17.3	34.7
Troubleshooting - High Power	104	4	15	104.0	–	–	–
Engine Trims	11	2	40	7.2	1.8	1.8	3.6
Engine Trims	1	4	10	0.8	–	–	–
ISO Runs	23	2	20	7.7	7.7		
ISO Runs	23	4	15	23.0	–	–	–
Backline Runs	23	2	3	1.2	–	–	1.2
Backline Runs	23	4	66	99.7	1.5	–	–
Post ISO Runs	23	2	40	15.3	–	–	15.3
Post ISO Runs	23	4	15	23.0	–	–	–
Total TIMs - KC-135				**909**	**28**	**19**	**55**

[a] Source is SAIC 2013c. Existing C-17/KC-135 scenario based upon 17/23 aircraft.

Key: – = No activity, # = number, FTU = Formal Training Unit, TIM = Time in Mode.

Table D.1-12. KC-46A Aircraft On-Wing Engine Testing Activity Data for Altus AFB – KC-46A Proposed Scenarios

Aircraft/Test Type	Tests/ Year	# of Engines	Duration (Minutes)	Engine Setting/Annual Engine Hours			
				Idle	*Approach*	*Intermediate*	*Takeoff*
KC-46A - FTU [a]							
Leak Checks/Troubleshooting	624	2	45	936.0	–	–	–
Fuel Transfer	208	1	80	277.3	–	–	–
Troubleshooting - High Power	104	2	55	121.3	17.3	17.3	34.7
Engine Trims	12	2	50	12.0	2.0	2.0	4.0
ISO Runs	8	2	35	6.7	2.7	–	–
Total TIMs - KC-46A FTU				**1,353**	**22**	**19**	**39**
KC-46A - MOB 1 [b]							
Leak Checks/Troubleshooting	624	2	45	936.0	–	–	–
Fuel Transfer	208	1	80	277.3	–	–	–
Troubleshooting - High Power	104	2	55	121.3	17.3	17.3	34.7
Engine Trims	12	2	50	12.0	2.0	2.0	4.0
ISO Runs	36	2	35	30.0	12.0		
Total TIMs - KC-46A MOB 1				**1,377**	**31**	**19**	**39**

[a] Source is SAIC 2013c

[b] Source is SAIC 2013f

Key: – = No activity, # = number, APU = auxiliary power unit, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, TIM = Time in Mode.

Table D.1-13. Aircraft Emission Factors by Engine Setting – Altus AFB KC-46A Project Alternatives

Engine/Setting	Fuel Flow (pounds/hour)	Emission Factors (pounds/1000 pounds Fuel) [a]						
		VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*
F117-PW-100 [b]								
Idle	978	0.43	22.70	3.76	1.06	10.67	10.67	3,216
Approach	4,645	0.06	0.51	15.49	1.06	5.53	5.53	3,216
Intermediate	10,408	0.05	0.32	32.72	1.06	2.31	2.31	3,216
Military	14,111	0.13	0.38	34.23	1.06	0.12	0.12	3,216
CFM56-2B-1 [c]								
Idle	1,014	2.10	30.70	4.00	1.06	0.06	0.06	3,216
Approach	2,463	0.09	4.20	8.20	1.06	0.06	0.06	3,216
Intermediate	6,486	0.06	0.09	16.00	1.06	0.05	0.05	3,216
Military	7,801	0.05	0.09	18.50	1.06	0.07	0.07	3,216
P&W 4062 [c]								
Idle	1,663	12.49	42.61	3.78	1.06	0.11	0.10	3,216
Approach	5,702	0.10	1.93	12.17	1.06	0.05	0.04	3,216
Intermediate	16,870	0.08	0.50	25.98	1.06	0.07	0.06	3,216
Military	21,622	0.09	0.61	34.36	1.06	0.08	0.07	3,216
KC-46A APU - Honeywell 331-400C [d]								
Pounds per Hour	–	0.04	0.33	6.72	0.56	0.05	0.04	1,373

[a] Data are for 1 engine. The C-17/KC-135/KC-46A have 4/4/2 engines.

[b] Data from Air Emissions Factor Guide to Air Force Mobile Sources (AFCEC 2013), except military data for the F117 engine from (AFCEE 2009).

[c] ICAO Engine Exhaust Emissions Data Bank – Subsonic Engines – (ICAO 2013)

[d] Source is Boeing 2013a.

Key: – = No activity, CO = carbon monoxide, CO_2 = carbon dioxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-14. Annual Air Emissions from Existing Aircraft On-Wing Engine Testing Activities for Altus AFB – Year 2012

Scenario/Engine Type	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
C-17										
Idle	0.14	7.68	1.27	0.36	3.61	3.61	1,088	0.030	0.034	1,099
Approach	0.00	0.01	0.34	0.02	0.12	0.12	70	0.002	0.002	70
Intermediate	0.01	0.07	7.22	0.23	0.51	0.51	710	0.020	0.022	717
Military	0.00	0.01	0.94	0.03	0.00	0.00	89	0.002	0.003	90
Subtotal C-17	**0.16**	**7.77**	**9.77**	**0.64**	**4.24**	**4.24**	**1,956**	**0.05**	**0.06**	**1,976**
KC-135										
Idle	0.97	14.15	1.84	0.49	0.03	0.03	1,482	0.041	0.046	1,497
Approach	0.00	0.15	0.29	0.04	0.00	0.00	112	0.003	0.003	113
Intermediate	0.00	0.01	0.99	0.07	0.00	0.00	200	0.006	0.006	202
Military	0.01	0.02	3.95	0.23	0.01	0.01	687	0.019	0.021	694
Subtotal KC-135	**0.99**	**14.32**	**7.07**	**0.82**	**0.05**	**0.05**	**2,481**	**0.07**	**0.08**	**2,506**
Total Emissions - 2012	**1.15**	**22.09**	**16.84**	**1.46**	**4.29**	**4.29**	**4,437**	**0.12**	**0.14**	**4,482**

Table D.1-14. Annual Air Emissions from Existing Aircraft On-Wing Engine Testing Activities for Altus AFB – Year 2012 (Continued)

Scenario/Engine Type	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
C-17										
Idle	0.004	–	0.008	–	–	–	0.000	–	0.000	0.001
Approach	–	–	0.000	–	–	–	0.000	0.000	0.000	0.000
Intermediate	–	–	0.000	–	0.000	–	0.000	–	0.000	0.000
Military	–	–	0.000	–	0.000	–	0.000	–	0.000	0.000
Subtotal C-17	**0.00**	**–**	**0.01**	**–**	**0.00**	**–**	**0.00**	**0.00**	**0.00**	**0.00**
KC-135										
Idle	–	–	0.001	–	–	–	0.001	0.000	–	–
Approach	–	–	0.000	–	–	0.000	0.000	0.000	–	–
Intermediate	–	–	0.000	–	–	0.000	0.000	0.000	–	–
Military	–	–	0.000	–	–	–	0.000	0.000	–	–
Subtotal KC-135	**–**	**–**	**0.00**	**–**	**–**	**0.00**	**0.00**	**0.00**	**–**	**–**
Total Emissions - 2012	**0.00**	**–**	**0.01**	**–**	**–**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Scenario/Engine Type	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
C-17					NR Only			NR Only		
Idle	0.002	0.001	0.001	0.080	–	–	0.000	–	0.001	0.001
Approach	0.000	0.000	–	0.000	–	–	-	–	–	–
Intermediate	0.001	0.000	–	0.002	–	–	0.001	–	–	–
Military	0.000	0.000	–	0.000	–	–	0.000	–	–	–
Subtotal C-17	**0.00**	**0.00**	**0.00**	**0.08**	**–**	**–**	**0.00**	**–**	**0.00**	**0.00**
KC-135					NR Only			NR Only		
Idle	–	0.003	0.000	0.044	–	–	0.031	–	0.001	–
Approach	–	0.000	0.000	0.001	–	–	0.002	–	–	–
Intermediate	–	0.000	–	0.000	–	–	0.003	–	–	–
Military	–	0.000	–	0.001	–	–	0.000	–	–	–
Subtotal KC-135	**–**	**0.00**	**0.00**	**0.05**	**–**	**–**	**0.04**	**–**	**0.00**	**–**
Total Emissions - 2012	**0.00**	**0.00**	**0.00**	**0.13**	**–**	**–**	**0.04**	**–**	**0.00**	**0.00**

Scenario/Engine Type	Annual Emissions - Tons									
	POM	*Propio-naldehyde*	*Styrene*	*1,1,2,2-Tetrachlor-oethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
C-17	NR Only	NR Only								
Idle	–	–	0.001	0.001	–	0.002	–	–	0.001	0.000
Approach	–	–	–	0.000	–	0.000	0.000	–	0.000	–
Intermediate	–	–	–	0.000	–	0.000	–	–	0.000	–
Military	–	–	–	0.000	–	0.000	–	–	0.000	–
Subtotal C-17	**–**	**–**	**0.00**	**0.00**	**–**	**0.00**	**0.00**	**–**	**0.00**	**0.00**
KC-135	NR Only	NR Only								
Idle	–	–	0.001	–	0.001	0.004	0.000	0.002	0.001	–
Approach	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–
Intermediate	–	–	–	–	0.000	0.000	-	0.000	0.000	–
Military	–	–	–	–	0.000	0.000	0.000	0.001	0.000	–
Subtotal KC-135	**–**	**–**	**0.00**	**–**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**–**
Total Emissions - 2012	**–**	**–**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**

Key: – = No activity, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, CH_4 = methane, hr = hour, ICAO = International Civil Aviation Organization, lb = pound, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-15. Annual Air Emissions from Aircraft On-Wing Engine Testing Activities for Altus AFB – KC-46A Proposed Scenarios

Scenario/Engine Type	Annual Emissions - Tons									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
KC-46A - FTU										
Idle	14.06	47.95	4.25	1.19	0.12	0.11	3,619	0.10	0.11	3,656
Approach	0.01	0.12	0.76	0.07	0.00	0.00	202	0.01	0.01	204
Intermediate	0.01	0.08	4.24	0.17	0.01	0.01	524	0.01	0.02	530
Military	0.04	0.25	14.36	0.44	0.03	0.03	1,344	0.04	0.04	1,358
APU	0.03	0.24	4.82	0.40	0.03	0.03	984	0.03	0.03	994
Subtotal KC-46A FTU	**14.14**	**48.41**	**23.62**	**1.88**	**0.17**	**0.15**	**5,690**	**0.16**	**0.18**	**5,748**
KC-46A - MOB 1										
Idle	14.30	48.78	4.33	1.21	0.13	0.11	3,682	0.10	0.11	3,719
Approach	0.01	0.17	1.09	0.09	0.00	0.00	287	0.01	0.01	290
Intermediate	0.01	0.08	4.24	0.17	0.01	0.01	524	0.01	0.02	530
Military	0.04	0.25	14.36	0.44	0.03	0.03	1,344	0.04	0.04	1,358
APU	0.03	0.24	4.93	0.41	0.03	0.03	1,006	0.03	0.03	1,017
Subtotal KC-46A MOB 1	**14.39**	**49.54**	**28.94**	**2.34**	**0.21**	**0.19**	**6,844**	**0.19**	**0.21**	**6,914**

Scenario/Engine Type	Annual Emissions - Tons									
	Acetalde-hyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Dibutyl Phthalate	1,2-Dichloro-propane
KC-46A - FTU										
Idle	0.606	0.347	0.238	0.239	–	–	–	–	–	–
Approach	0.000	0.000	0.000	0.000	–	–	–	–	–	–
Intermediate	0.001	0.000	0.000	0.000	–	–	–	–	–	–
Military	0.002	0.001	0.001	0.001	–	–	–	–	–	–
APU	0.001	0.001	0.001	0.001	–	–	–	–	–	–
Subtotal KC-46A FTU	**0.61**	**0.35**	**0.24**	**0.24**	**–**	**–**	**–**	**–**	**–**	**–**
KC-46A - MOB 1										
Idle	0.616	0.353	0.243	0.243	-	-	-	-	-	-
Approach	0.000	0.000	0.000	0.000	-	-	-	-	-	-
Intermediate	0.001	0.000	0.000	0.000	-	-	-	-	-	-
Military	0.002	0.001	0.001	0.001	-	-	-	-	-	-
APU	0.001	0.001	0.001	0.001	-	-	-	-	-	-
Subtotal KC-46A MOB 1	**0.620**	**0.356**	**0.244**	**0.245**	**-**	**-**	**-**	**-**	**-**	**-**

Table D.1-15. Annual Air Emissions from Aircraft On-Wing Engine Testing Activities for Altus AFB – KC-46A Proposed Scenarios (Continued)

Scenario/Engine Type	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formald-ehyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
KC-46A - FTU					NR Only			NR Only		
Idle	–	–	0.025	1.745	–	0.256	–	–	0.077	0.103
Approach	–	–	0.000	0.001	–	0.000	–	–	0.000	0.000
Intermediate	–	–	0.000	0.002	–	0.000	–	–	0.000	0.000
Military	–	–	0.000	0.005	–	0.001	–	–	0.000	0.000
APU	–	–	0.000	0.004	–	0.001	–	–	0.000	0.000
Subtotal KC-46A FTU	**–**	**–**	**0.02**	**1.75**	**–**	**0.26**	**–**	**–**	**0.08**	**0.10**
KC-46A - MOB 1										
Idle	-	-	0.025	1.775	-	0.260	-	-	0.078	0.105
Approach	-	-	0.000	0.001	-	0.000	-	-	0.000	0.000
Intermediate	-	-	0.000	0.002	-	0.000	-	-	0.000	0.000
Military	-	-	0.000	0.005	-	0.001	-	-	0.000	0.000
APU	-	-	0.000	0.004	-	0.001	-	-	0.000	0.000
Subtotal KC-46A MOB 1	**-**	**-**	**0.025**	**1.787**	**-**	**0.262**	**-**	**-**	**0.079**	**0.105**

Scenario/Engine Type	Annual Emissions - Tons									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-46A - FTU	NR Only	NR Only								
Idle	–	–	0.044	–	–	0.091	–	–	0.040	0.024
Approach	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Intermediate	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Military	–	–	0.000	–	–	0.000	–	–	0.000	0.000
APU	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	**–**	**–**	**0.04**	**–**	**–**	**0.09**	**–**	**–**	**0.04**	**0.02**
KC-46A - MOB 1										
Idle	-	-	0.045	-	-	0.093	-	-	0.041	0.024
Approach	-	-	0.000	-	-	0.000	-	-	0.000	0.000
Intermediate	-	-	0.000	-	-	0.000	-	-	0.000	0.000
Military	-	-	0.000	-	-	0.000	-	-	0.000	0.000
APU	-	-	0.000	-	-	0.000	-	-	0.000	0.000
Subtotal KC-46A MOB 1	**-**	**-**	**0.045**	**-**	**-**	**0.093**	**-**	**-**	**0.041**	**0.024**

Key: – = No activity, APU = auxiliary power unit, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-16. KC-46A Aircraft Landings and Take-offs at Altus AFB – KC-46A Proposed Scenarios

Scenario/Operation	Operations/ Year	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		Idle	*Approach*	*Climbout*	*Takeoff*	*Idle*	*Approach*	*Climbout*	*Takeoff*
FTU [a]									
LTO	1,827	47.7	5.2	1.6	0.7	1,452	158	49	21
Total TIMs - KC-46A FTU LTOs	NA	NA	NA	NA	NA	**1,452**	**158**	**49**	**21**
MOB 1 [b]									
LTO	2,815	47.7	5.2	1.6	0.7	2,238	244	75	33
Total TIMs - KC-46A MOB 1 LTOs	NA	NA	NA	NA	NA	**2,238**	**244**	**75**	**33**

[a] EIS Table 2-5 and SAIC 2013k.

[b] EIS Table 2-8 and SAIC 2013l.

Key: FTU = Formal Training Unit, LTO = landing and takeoff, MOB 1 = First Main Operating Base, TIM = Time in Mode.

Table D.1-17. KC-46A Aircraft Closed Pattern Operations at Altus AFB – KC-46A Proposed Scenarios

Scenario/Operation	Operations/ Year	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	*60%*	*Climbout*	*Takeoff*	*55%*	*60%*	*Climbout*	*Takeoff*
FTU [a]									
Closed Pattern - Radar & Initial to Overhead	9,419	12.0	2.0	–	1.0	1,884	314	–	157
Closed Pattern - VFR	6,740	5.0	2.0	–	1.0	562	225	–	112
Closed Pattern - Tactical	2,494	8.0	2.0	2.0	1.0	333	83	83	42
Total TIMs - KC-46A FTU						**2,778**	**622**	**83**	**311**
MOB 1 [b]									
Closed Pattern - Radar & Initial to Overhead	6,415	12.0	2.0	–	1.0	1,283	214	–	107
Closed Pattern - VFR	4,357	5.0	2.0	–	1.0	363	145	–	73
Closed Pattern - Tactical	3,023	8.0	2.0	2.0	1.0	403	101	101	50
Total TIMs - KC-46A MOB 1						**2,049**	**460**	**101**	**230**

[a] EIS Table 2-5 and SAIC 2013k. Closed Pattern – Tactical ops reduced by 7.5% to reflect amount of time above 3,000 feet AGL.

[b] EIS Table 2-8 and SAIC 2013l. Closed Pattern – Tactical ops reduced by 7.5% to reflect amount of time above 3,000 feet AGL

Key: – = No activity, % = percent, AGL = above ground level, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, ops = operations, TIM = Time in Mode, VFR = visual flight rules.

Table D.1-18. APU Usage per LTO for the KC-46A Aircraft

Equipment Type/Mode	Hours/Mode
APU	
Pre-Flight - OBIGGS + Electric + Maximum ECS	1.50
Pre-Flight - Main Engine Start + Electric	0.03
Post-Flight - Electric + Minimum ECS	0.58
Total Hours per LTO	**2.12**

Key: APU = auxiliary power unit, ECS = Environmental Control System, LTO = landing and takeoff, OBIGGS = On-Board Inert Gas Generation System

Source: Boeing 2013a.

Table D.1-19. Emissions Factors by Engine Setting for the KC-46A Aircraft

Engine/Setting	Fuel Flow (lbs/hr)	Emission Factors (Pounds/1000 Pounds Fuel)[a]						
		VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*
P&W 4062 [b]								
Idle (7%)	1,663	12.49	42.61	3.78	1.06	0.11	0.10	3,216
Approach (30%)	5,702	0.10	1.93	12.17	1.06	0.05	0.04	3,216
Climbout (85%)	16,870	0.08	0.50	25.98	1.06	0.07	0.06	3,216
Take-off (100%)	21,622	0.09	0.61	34.36	1.06	0.08	0.07	3,216
APU - Honeywell 331-400C [c]								
Pounds per Hour	–	0.04	0.33	6.72	0.56	0.05	0.04	1,373

[a] Data are for 1 engine – the KC-46A has 2 engines.

[b] ICAO Engine Exhaust Emissions Data Bank – Subsonic Engines – (ICAO 2013).

[c] Source is Boeing 2013a.

Key: % = percent, APU = auxiliary power unit, CO = carbon monoxide, CO_2 = carbon dioxide, hr = hour, ICAO = International Civil Aviation Organization, lbs = pounds, NO_x = nitrogen oxides, P&W = Pratt & Whitney, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-20. Interpolated Emissions Factors by Engine Setting for the KC-46A Aircraft – Closed Patterns

Engine/N Setting from Noise	Fuel Flow (lbs/hr)	Emission Factors (Pounds/1000 Pounds Fuel)						
		VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*
P&W 4062								
55%	10,778	0.09	1.28	18.45	1.06	0.06	0.05	3,216
60%	11,794	0.09	1.15	19.70	1.06	0.06	0.05	3,216

Key: % = percent, CO = carbon monoxide, CO_2 = carbon dioxide, hr = hour, lbs = pounds, NO_x = nitrogen oxides, P&W = Pratt & Whitney, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-21. Annual Air Emissions from KC-46A Operations at Altus AFB – Year 2016

Scenario/Operation/Engine Setting	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
FTU/LTOs										
Idle	30.16	102.91	9.13	2.56	0.27	0.24	7,767	0.21	0.24	7,846
Approach	0.09	1.74	10.99	0.96	0.05	0.04	2,903	0.08	0.09	2,933
Climbout	0.07	0.41	21.35	0.87	0.06	0.05	2,642	0.07	0.08	2,669
Take-off	0.04	0.28	15.83	0.49	0.04	0.03	1,482	0.04	0.05	1,497
APU	0.08	0.65	12.99	1.09	0.09	0.08	2,654	0.07	0.08	2,681
Subtotal FTU LTOs	**30.45**	**105.99**	**70.28**	**5.96**	**0.50**	**0.44**	**17,448**	**0.48**	**0.54**	**17,626**
FTU/Closed Patterns										
55%	2.79	38.33	552.35	31.74	1.77	1.47	96,293	2.66	2.99	97,278
60%	0.67	8.43	144.48	7.77	0.45	0.37	23,582	0.65	0.73	23,823
Climbout	0.11	0.70	36.43	1.49	0.10	0.08	4,510	0.12	0.14	4,556
Take-off	0.62	4.10	230.96	7.13	0.54	0.47	21,617	0.60	0.67	21,838
Subtotal FTU Closed Patterns	**4.18**	**51.56**	**964.22**	**48.12**	**2.85**	**2.40**	**146,003**	**4.04**	**4.54**	**147,495**
Total FTU Operations	**34.63**	**157.55**	**1,034.50**	**54.09**	**3.35**	**2.84**	**163,451**	**4.52**	**5.08**	**165,121**
MOB 1/LTOs										
Idle	46.49	158.60	14.07	3.95	0.41	0.37	11,970	0.33	0.37	12,093
Approach	0.14	2.69	16.93	1.47	0.07	0.06	4,474	0.12	0.14	4,520
Climbout	0.10	0.63	32.90	1.34	0.09	0.08	4,073	0.11	0.13	4,114
Take-off	0.07	0.43	24.40	0.75	0.06	0.05	2,284	0.06	0.07	2,307
APU	0.13	1.00	20.02	1.67	0.14	0.13	4,090	0.11	0.13	4,132
Subtotal MOB 1 LTOs	**46.93**	**163.35**	**108.32**	**9.19**	**0.76**	**0.68**	**26,890**	**1**	**1**	**27,165**
MOB 1/Closed Patterns										
55%	2.06	28.27	407.43	23.41	1.31	1.08	71,029	1.97	2.21	71,755
60%	0.49	6.24	106.85	5.75	0.33	0.28	17,440	0.48	0.54	17,619
Climbout	0.14	0.85	44.16	1.80	0.12	0.10	5,467	0.15	0.17	5,522
Take-off	0.46	3.03	170.81	5.27	0.40	0.35	15,987	0.44	0.50	16,150
Subtotal MOB 1 Closed Patterns	**3.14**	**38.39**	**729.24**	**36.23**	**2.15**	**1.81**	**109,923**	**3.04**	**3.42**	**111,046**
Total MOB 1 Operations	**50.07**	**201.73**	**837.56**	**45.42**	**2.92**	**2.49**	**136,813**	**3.79**	**4.25**	**138,212**

Scenario/Operation/Engine Setting	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
FTU/LTOs										
Idle	1.300	0.745	0.512	0.513	–	–	–	–	–	–
Approach	0.004	0.002	0.002	0.002	–	–	–	–	–	–
Climbout	0.003	0.002	0.001	0.001	–	–	–	–	–	–
Take-off	0.002	0.001	0.001	0.001	–	–	–	–	–	–
APU	0.004	0.002	0.001	0.001	–	–	–	–	–	–
Subtotal FTU LTOs	**1.31**	**0.75**	**0.52**	**0.52**	**–**	**–**	**–**	**–**	**–**	**–**
FTU/Closed Patterns										
55%	0.120	0.069	0.047	0.047	–	–	–	–	–	–
60%	0.029	0.016	0.011	0.011	–	–	–	–	–	–
Climbout	0.005	0.003	0.002	0.002	–	–	–	–	–	–
Take-off	0.027	0.015	0.010	0.011	–	–	–	–	–	–
Subtotal FTU Closed Patterns	**0.180**	**0.103**	**0.071**	**0.071**	**–**	**–**	**–**	**–**	**–**	**–**
Total FTU Operations	**1.49**	**0.86**	**0.59**	**0.59**	**–**	**–**	**–**	**–**	**–**	**–**
MOB 1/LTOs										
Idle	2.003	1.148	0.788	0.791	–	–	–	–	–	–
Approach	0.006	0.004	0.002	0.002	–	–	–	–	–	–
Climbout	0.004	0.003	0.002	0.002	–	–	–	–	–	–
Take-off	0.003	0.002	0.001	0.001	–	–	–	–	–	–
APU	0.006	0.003	0.002	0.002	–	–	–	–	–	–
Subtotal MOB 1 LTOs	**2.02**	**1.16**	**0.80**	**0.80**	**–**	**–**	**–**	**–**	**–**	**–**
MOB 1/Closed Patterns										
55%	0.089	0.051	0.035	0.035	–	–	–	–	–	–
60%	0.021	0.012	0.008	0.008	–	–	–	–	–	–
Climbout	0.006	0.003	0.002	0.002	–	–	–	–	–	–
Take-off	0.020	0.011	0.008	0.008	–	–	–	–	–	–
Subtotal MOB 1 Closed Patterns	**0.135**	**0.078**	**0.053**	**0.053**	**–**	**–**	**–**	**–**	**–**	**–**
Total MOB 1 Operations	**2.16**	**1.24**	**0.85**	**0.85**	**–**	**–**	**–**	**–**	**–**	**–**

Table D.1-21. Annual Air Emissions from KC-46A Operations at Altus AFB – Year 2016 (Continued)

Scenario/Operation/Engine Setting	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphtha-lene*	*Phenol*
FTU/LTOs										
Idle	–	–	0.053	3.745	–	0.549	–	–	0.165	0.221
Approach	–	–	0.000	0.012	–	0.002	–	–	0.001	0.001
Climbout	–	–	0.000	0.008	–	0.001	–	–	0.000	0.000
Take-off	–	–	0.000	0.005	–	0.001	–	–	0.000	0.000
APU	–	–	0.000	0.010	–	0.002	–	–	0.000	0.001
Subtotal FTU LTOs	**–**	**–**	**0.05**	**3.78**	**–**	**0.55**	**–**	**–**	**0.17**	**0.22**
FTU/Closed Patterns										
55%	–	–	0.005	0.346	–	0.051	–	–	0.015	0.020
60%	–	–	0.001	0.083	–	0.012	–	–	0.004	0.005
Climbout	–	–	0.000	0.014	–	0.002	–	–	0.001	0.001
Take-off	–	–	0.001	0.077	–	0.011	–	–	0.003	0.005
Subtotal FTU Closed Patterns	**–**	**–**	**0.007**	**0.519**	**–**	**0.076**	**–**	**–**	**0.023**	**0.031**
Total FTU Operations	**–**	**–**	**0.06**	**4.30**	**–**	**0.63**	**–**	**–**	**0.19**	**0.25**
MOB 1/LTOs										
Idle	–	–	0.082	5.771	–	0.846	–	–	0.254	0.341
Approach	–	–	0.000	0.018	–	0.003	–	–	0.001	0.001
Climbout	–	–	0.000	0.013	–	0.002	–	–	0.001	0.001
Take-off	–	–	0.000	0.008	–	0.001	–	–	0.000	0.000
APU	–	–	0.000	0.016	–	0.002	–	–	0.001	0.001
Subtotal MOB 1 LTOs	**–**	**–**	**0.08**	**5.83**	**–**	**0.85**	**–**	**–**	**0.26**	**0.34**
MOB 1/Closed Patterns										
55%	–	–	0.004	0.255	–	0.037	–	–	0.011	0.015
60%	–	–	0.001	0.061	–	0.009	–	–	0.003	0.004
Climbout	–	–	0.000	0.017	–	0.002	–	–	0.001	0.001
Take-off	–	–	0.001	0.057	–	0.008	–	–	0.002	0.003
Subtotal MOB 1 Closed Patterns	**–**	**–**	**0.006**	**0.390**	**–**	**0.057**	**–**	**–**	**0.017**	**0.023**
Total MOB 1 Operations	**–**	**–**	**0.09**	**6.22**	**–**	**0.91**	**–**	**–**	**0.27**	**0.37**

Scenario/Operation/Engine Setting	Annual Emissions - Tons									
	POM	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
FTU/LTOs										
Idle	–	–	0.094	–	–	0.195	–	–	0.086	0.051
Approach	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Climbout	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	–	–	0.000	–	–	0.000	0.000
APU	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Subtotal FTU LTOs	**–**	**–**	**0.10**	**–**	**–**	**0.20**	**–**	**–**	**0.09**	**0.05**
FTU/Closed Patterns										
55%	–	–	0.009	–	–	0.018	–	–	0.008	0.005
60%	–	–	0.002	–	–	0.004	–	–	0.002	0.001
Climbout	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Take-off	–	–	0.002	–	–	0.004	–	–	0.002	0.001
Subtotal FTU Closed Patterns	**–**	**–**	**0.013**	**–**	**–**	**0.027**	**–**	**–**	**0.012**	**0.007**
Total FTU Operations	**–**	**–**	**0.11**	**–**	**–**	**0.22**	**–**	**–**	**0.10**	**0.06**
MOB 1/LTOs										
Idle	–	–	0.145	–	–	0.301	–	–	0.132	0.078
Approach	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Climbout	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Take-off	–	–	0.000	–	–	0.000	–	–	0.000	0.000
APU	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Subtotal MOB 1 LTOs	**–**	**–**	**0.15**	**–**	**–**	**0.30**	**–**	**–**	**0.13**	**0.08**
MOB 1/Closed Patterns										
55%	–	–	0.006	–	–	0.013	–	–	0.006	0.003
60%	–	–	0.002	–	–	0.003	–	–	0.001	0.001
Climbout	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Take-off	–	–	0.001	–	–	0.003	–	–	0.001	0.001
Subtotal MOB 1 Closed Patterns	**–**	**–**	**0.010**	**–**	**–**	**0.020**	**–**	**–**	**0.009**	**0.005**
Total MOB 1 Operations	**–**	**–**	**0.16**	**–**	**–**	**0.32**	**–**	**–**	**0.14**	**0.08**

Key: – = Source does not emit particular pollutant, % = percent, APU = auxiliary power unit, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, LTO = landing and takeoff, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-22. Annual Aircraft LTOs at Altus AFB – KC-46A Project Scenarios

Aircraft	Annual LTOs			
	2008	*2012*	*FTU*	*MOB 1*
C-17	17,052	5,038	5,038	5,038
KC-135	6,702	1,980	1,980	1,980
Transient	195	341	341	341
KC-46A			1,827	2,815
Total LTOs	**25,957**	**9,371**	**9,185**	**10,174**

Key: FTU = Formal Training Unit, LTO = landing and takeoff, MOB 1 = First Main Operating Base.

Table D.1-23. Annual Nonroad Emission Factors – Altus AFB KC-46A Scenarios

HP Category/ Fuel Type	Emission Factors (Grams/Horsepower)[a]						
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*
Year 2008							
Diesel	1.13	3.03	14.06	0.93	1.00	1.00	562
Year 2012							
100-175 HP Diesel	0.54	3.92	4.58	0.13	0.61	0.56	608
Year 2016 FTU or MOB 1							
100-175 HP Diesel	0.38	2.75	3.11	0.12	0.46	0.42	608

[a] Year 2008 data from 2008 AEI (Weston Solutions, Inc. 2008), which assume uncontrolled factors. Year 2012/2016 factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Jackson County, OK.

Key: CO = carbon monoxide, CO_2 = carbon dioxide, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HP = horsepower, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, OK = Oklahoma, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-24. Annual Air Emissions for AGE Usages – Altus AFB KC-46A Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
Aerospace Ground Support Equipment	5.70	15.30	71.00	4.70	5.04	5.00	15,753	2.61	0.19	15,865
Subtotal - Year 2008	**5.70**	**15.30**	**71.00**	**4.70**	**5.04**	**5.00**	**15,753**	**2.61**	**0.19**	**15,865**
Year 2016 - FTU Scenario										
Aerospace Ground Support Equipment[a]	0.13	0.98	1.11	0.04	0.16	0.15	1,199	0.19	0.00	1,203
Subtotal - FTU Scenario	**0.13**	**0.98**	**1.11**	**0.04**	**0.16**	**0.15**	**1,199**	**0.19**	**0.00**	**1,203**
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.21	1.51	1.70	0.07	0.25	0.23	1,848	0.29	0.00	1,854
Subtotal - MOB 1 Scenario	**0.21**	**1.51**	**1.70**	**0.07**	**0.25**	**0.23**	**1,848**	**0.29**	**0.00**	**1,854**

Scenario/Source	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Year 2008										
Aerospace Ground Support Equipment	0.014	0.002	0.060	0.009	–	–	–	–	–	–
Subtotal - Year 2008	**0.01**	**0.00**	**0.06**	**0.01**	–	–	–	–	–	–
Year 2016 - FTU Scenario										
Aerospace Ground Support Equipment[a]	0.000	0.000	0.001	0.000	–	–	–	–	–	–
Subtotal - FTU Scenario	**0.00**	**0.00**	**0.00**	**0.00**	–	–	–	–	–	–
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.001	0.000	0.002	0.000	–	–	–	–	–	–
Subtotal - MOB 1 Scenario	**0.00**	**0.00**	**0.00**	**0.00**	–	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphtha-lene*	*Phenol*
Year 2008										
Aerospace Ground Support Equipment	–	–	0.018	0.027	0.009	–	–	0.140	0.001	–
Subtotal - Year 2008	–	–	**0.02**	**0.03**	**0.01**	–	–	**0.14**	**0.00**	–
Year 2016 - FTU Scenario										
Aerospace Ground Support Equipment[a]	–	–	0.000	0.001	0.000	–	–	0.003	0.000	–
Subtotal - FTU Scenario	–	–	**0.00**	**0.00**	**0.00**	–	–	**0.00**	**0.00**	–
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	–	–	0.001	0.001	0.000	–	–	0.005	0.000	–
Subtotal - MOB 1 Scenario	–	–	**0.00**	**0.00**	**0.00**	–	–	**0.01**	**0.00**	–

Scenario/Source	Annual Emissions - Tons									
	POM	*Propional-dehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2008										
Aerospace Ground Support Equipment	0.002	0.002	0.001	–	–	0.070	–	–	–	0.065
Subtotal - Year 2008	**0.00**	**0.00**	**0.00**	–	–	**0.07**	–	–	–	**0.07**
Year 2016 - FTU Scenario										
Aerospace Ground Support Equipment[a]	0.000	0.000	0.000	–	–	0.002	–	–	–	0.002
Subtotal - FTU Scenario	**0.00**	**0.00**	**0.00**	–	–	**0.00**	–	–	–	**0.00**
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.000	0.000	0.000	–	–	0.003	–	–	–	0.002
Subtotal - MOB 1 Scenario	**0.00**	**0.00**	**0.00**	–	–	**0.00**	–	–	–	**0.00**

[a] 2008 AGE emissions * 2016 KC-46A LTOs / 2008 total LTOs * 2016/2008 Nonroad EFs.

Key: AGE = aerospace ground equipment, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EF = emission factors, FTU = Formal Training Unit, LTO = landing and takeoff, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-25. Annual VMT for GMVs by Vehicle Class – Altus AFB KC-46A Project Scenarios

Vehicle Class	Annual VMT[a]			
	2008	*Year 2012*	*Year 2016 FTU*	*Year 2016 MOB 1*
LDGV	49,865	47,999	55,561	71,593
LDGT1	51,039	49,129	56,869	73,279
LDGT2	1,140	1,097	1,270	1,637
HDGV	5,178	4,984	5,769	7,434
LDDT	2,817	2,712	3,139	4,044
HDDV	206,933	199,190	230,571	297,103
Totals	**316,972**	**305,111**	**353,180**	**455,091**

[a] Future year estimates based on ratio of future year/2008 Altus AFB worker populations.

Key: AFB = Air Force Base, FTU = Formal Training Unit, GMV = government motor vehicle, HDDV = heavy duty diesel vehicle, HDGV = heavy duty gasoline vehicle, LDDT = light duty diesel truck, LDGT = light duty gasoline truck, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, VMT = vehicle miles traveled.

Table D.1-26. Annual Worker Population at Altus AFB – KC-46A Project Scenarios

Scenario	Total # of Workers[a]	Fraction of 2008	Scenario Total Workers minus 2008 Total Workers	Fraction of 2008
Year 2008	4,062	1.00	4,062	1.00
Year 2012	3,910	0.96	(152)	(0.04)
Year 2016 FTU	4,526	1.114	464	0.11
Year 2016 MOB 1	5,832	1.436	1,770	0.44

[a] For year 2008, # of personnel obtained from 2008 Altus AFB Economic Impacts Statement (Altus AFB Comptroller Squadron 2008) and EIS Tables 2-4 and 2-7 for all other scenarios.

Key: # = number, ( ) = parenthesis indicate negative numbers, AFB = Air Force Base, FTU = Formal Training Unit, MOB 1 = First Main Operating Base.

Table D.1-27. Annual Average On-Road Vehicle Emission Factors – Altus AFB KC-46A Scenarios

Scenario/ Vehicle Class	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
LDGV	0.40	6.20	0.40	0.07	0.71	0.20	368	0.001	0.0002	368
LDGT1	0.50	8.90	0.70	0.10	1.08	0.29	444	0.001	0.0002	444
LDGT2	1.20	16.90	1.20	0.10	2.58	0.66	444	0.001	0.0002	444
HDGV	1.10	13.50	3.00	0.15	5.51	1.42	444	0.001	0.0002	444
LDDT	0.90	1.80	1.40	0.16	1.59	0.48	1,246	0.001	0.001	1,246
HDDV	2.00	11.30	6.50	0.51	7.73	2.01	1,246	0.001	0.001	1,246
Year 2012										
LDGV - Road 3	0.06	2.23	0.39	0.00	0.02	0.01	321	0.001	0.0001	321
LDGT1	0.17	4.97	0.99	0.01	0.03	0.01	444	0.001	0.0002	444
LDGT2	0.17	4.97	0.99	0.01	0.03	0.01	444	0.001	0.0002	444
HDGV	0.17	4.97	0.99	0.01	0.03	0.01	444	0.001	0.0002	444
LDDT	0.42	2.10	3.04	0.00	0.21	0.19	619	0.000	0.000	619
HDDV - Road 3	0.42	2.51	10.25	0.01	0.56	0.50	1,949	0.001	0.001	1,949
Year 2016 FTU or MOB 1										
LDGV - Road 3	0.03	1.65	0.19	0.00	0.02	0.01	302	0.001	0.0001	302
LDGT1	0.12	4.02	0.73	0.01	0.03	0.01	413	0.001	0.0002	413
LDGT2	0.12	4.02	0.73	0.01	0.03	0.01	444	0.001	0.0002	444
HDGV	0.12	4.02	0.73	0.01	0.03	0.01	444	0.001	0.0002	444
LDDT	0.25	1.31	1.91	0.00	0.13	0.12	619	0.000	0.000	619
HDDV - Road 3	0.25	1.57	6.44	0.01	0.36	0.30	1,949	0.001	0.001	1,949

[a] Year 2008 factors from 2008 AEI (Weston Solutions, Inc. 2008). Year 2012 and 2016 factors estimated with the use of the EPA MOVES2010b model (USEPA 2013) for Road 3 conditions and based on default parameters for Jackson County.

Key: AEI = Air Emissions Inventory, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, HDGV = heavy duty gasoline vehicle, LDDT = light duty diesel truck, LDGT = light duty gasoline truck, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-28. Annual Emissions from GMV Activities on Altus AFB – KC-46A Project Scenarios

Scenario/ Vehicle Class	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
LDGV	0.02	0.34	0.02	0.00	0.04	0.01	20	0.00	0.00	20.25
LDGT1	0.03	0.50	0.04	0.01	0.06	0.02	25	0.00	0.00	24.95
LDGT2	0.00	0.02	0.00	0.00	0.00	0.00	1	0.00	0.00	0.56
HDGV	0.01	0.08	0.02	0.00	0.03	0.01	3	0.00	0.00	2.60
LDDT	0.00	0.01	0.00	0.00	0.00	0.00	4	0.00	0.00	3.80
HDDV	0.46	2.58	1.48	0.12	1.76	0.46	293	0.00	0.00	293.13
Total	**0.52**	**3.52**	**1.56**	**0.13**	**1.90**	**0.50**	**345.23**	**0.00**	**0.00**	**345.28**
Year 2012										
LDGV	0.00	0.12	0.02	0.00	0.00	0.00	17.00	0.00	0.00	17.00
LDGT1	0.01	0.27	0.05	0.00	0.00	0.00	24.01	0.00	0.00	24.02
LDGT2	0.00	0.01	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.54
HDGV	0.00	0.03	0.01	0.00	0.00	0.00	2.50	0.00	0.00	2.50
LDDT	0.00	0.01	0.01	0.00	0.00	0.00	1.82	0.00	0.00	1.82
HDDV	0.09	0.55	2.25	0.00	0.12	0.11	441.35	0.00	0.00	441.42
Total	**0.11**	**0.98**	**2.34**	**0.00**	**0.13**	**0.11**	**487.22**	**0.00**	**0.00**	**487.29**
Year 2016 FTU										
LDGV	0.00	0.10	0.01	0.00	0.00	0.00	18.52	0.00	0.00	18.53
LDGT1	0.01	0.25	0.05	0.00	0.00	0.00	25.89	0.00	0.00	25.90
LDGT2	0.00	0.01	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.62
HDGV	0.00	0.03	0.00	0.00	0.00	0.00	2.90	0.00	0.00	2.90
LDDT	0.00	0.00	0.01	0.00	0.00	0.00	2.10	0.00	0.00	2.10
HDDV	0.07	0.40	1.63	0.00	0.09	0.08	510.94	0.00	0.00	511.02
Total	**0.08**	**0.79**	**1.70**	**0.00**	**0.09**	**0.08**	**560.97**	**0.00**	**0.00**	**561.06**
Year 2016 MOB 1										
LDGV	0.00	0.13	0.02	0.00	0.00	0.00	23.87	0.00	0.00	23.87
LDGT1	0.01	0.32	0.06	0.00	0.00	0.00	33.36	0.00	0.00	33.37
LDGT2	0.00	0.01	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.80
HDGV	0.00	0.03	0.01	0.00	0.00	0.00	3.73	0.00	0.00	3.73
LDDT	0.00	0.01	0.01	0.00	0.00	0.00	2.71	0.00	0.00	2.71
HDDV	0.08	0.51	2.10	0.00	0.12	0.10	658.37	0.00	0.00	658.47
Total	**0.10**	**1.01**	**2.19**	**0.01**	**0.12**	**0.10**	**722.84**	**0.00**	**0.00**	**722.95**

Note: Future year emissions = 2008 emissions * future scenario worker fraction of 2008 * future scenario year vehicle emission factor/ 2008 vehicle emission factor.

Key: CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, GMV = government motor vehicle, HDDV = heavy duty diesel vehicle, HDGV = heavy duty gasoline vehicle, LDDT = light duty diesel truck, LDGT = light duty gasoline truck, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-29. Annual On Base On-Road POV Mileage Calculations – Altus AFB KC-46A Project Scenarios

Scenario	Total # of Workers[a]	Worker Fraction of 2008	Annual On Base VMT[b]
Year 2008	4,062	1.00	3,421,359
Year 2012	3,910	0.96	3,293,332
Year 2016 FTU	4,526	1.11	3,812,179
Year 2016 MOB 1	5,831	1.44	4,911,360

[a] For year 2008, # of personnel obtained from 2008 Altus AFB Economic Impacts Statement (Altus AFB Comptroller Squadron 2008) and EIS Tables 2-4 and 2-7 for all other scenarios.

[b] Distance from gate to center of Altus AFB, except shorter distance to lunch locations.

Key: # = number, AFB = Air Force Base, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, VMT = vehicle miles traveled.

Table D.1-30. Annual Average On-Road Emission Factors – Altus AFB KC-46A Proposed Actions

Project Year/ Source Type	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
LDGV	0.50	8.30	0.60	0.07	0.71	0.20	368	0.00	0.00	368
HDDV	2.00	10.90	6.50	0.51	7.73	2.01	1,246	0.00	0.00	1,246
Composite[b]	0.50	8.31	0.62	0.07	0.73	0.21	371	0.00	0.00	371
Year 2012										
LDGV - Road 3	0.06	2.23	0.39	0.00	0.02	0.01	321	0.00	0.00	321
HDDV - Road 3	0.42	2.51	10.25	0.01	0.56	0.50	1,949	0.00	0.00	1,949
Composite[b]	0.06	2.23	0.42	0.00	0.02	0.01	326	0.00	0.00	326
Year 2016 FTU										
LDGV - Road 3	0.03	1.65	0.19	0.00	0.02	0.01	302	0.00	0.00	302
HDDV - Road 3	0.25	1.57	6.44	0.01	0.36	0.30	1,949	0.00	0.00	1,949
Composite[b]	0.03	1.65	0.21	0.00	0.02	0.01	307	0.00	0.00	307

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Jackson County

[b] Equal to 99.7/0.3% LDGV/HDDV.

Key: % = percent, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-31. Annual Emissions from On Base On-Road Vehicle Activities – Altus AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*CO*	*NOx*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008	1.90	31.30	2.30	0.28	2.75	0.77	1,416	0.003	0.001	1,416
Year 2012	0.23	8.09	1.49	0.02	0.07	0.04	1,198	0.002	0.000	1,198
Year 2016 FTU	0.13	6.91	0.87	0.02	0.08	0.04	1,307	0.003	0.001	1,308
Year 2016 MOB 1	0.16	8.90	1.12	0.03	0.10	0.05	1,684	0.003	0.001	1,685

Note: Future year emissions = 2008 emissions * future scenario worker fraction of 2008 * future scenario year vehicle emission factor/ 2008 vehicle emission factor.

Key: CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-32. Annual Off-Base On-Road Vehicle Trip Calculations – Altus AFB Year 2008

Trip Type	Total # of Workers[a]	Round Trips per Year	Round Trips per Year Off Base	Miles per Round Trip[b]	Total VMT for Off Base Trips[c]
Workers					
Military - Off Base Residents[d]	879	250	219,780	7.0	1,538,460
Civilian	1,286	250	321,500	7.0	2,250,500
Contractor	905	250	226,250	7.0	1,583,750
Lunch Trips Off-Base	1,535	250	383,765	4.0	1,535,060
Retirees					
Local	1,440	104	149,760	7.0	1,048,320
Events					
Air Show	5,000	1	5,000	7.0	35,000
Miscellaneous	842	1	842	7.0	5,894
HDDV					
Buses	1	3,322	3,322	7.0	23,254
Fuel Deliveries	1	1,347	1,347	7.0	9,429
Week-End					
Military - On Base Residents[d]	440	104	45,714	7.0	320,000
Totals - LDGV[c]			**1,352,611**		**8,316,984**
Totals - HDDV[c]			**4,669**		**32,683**
Total Trips			**1,357,280**		**8,349,667**

[a] For year 2008, # of personnel obtained from Altus AFB Comptroller Squadron 2008, except see (d).

[b] Distance from gate to center of town, except shorter distance to lunch locations.

[c] All vehicles other than buses and fuel delivery trucks are LDGV.

[d] # of personnel estimated from Altus AFB Comptroller Squadron 2011.

Key: # = number, AFB = Air Force Base, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle.

Table D.1-33. Annual Off Base On-Road Vehicle Mileage Calculations – Altus AFB KC-46A Project Scenarios

Scenario	# of Workers	Fraction of 2008	LDGV Off Base VMT	HDDV Off Base VMT
Year 2008	4,062	1.00	8,316,984	32,683
Year 2012	3,910	0.96	8,005,762	31,460
Year 2016 FTU	4,526	1.11	9,267,028	36,416
Year 2016 MOB 1	5,831	1.44	11,939,028	46,916

Key: # = number, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, VMT = vehicle miles traveled.

Table D.1-34. Annual Average On-Road Emission Factors – Altus AFB KC-46A Proposed Actions

Project Year/ Source Type	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
LDGV - Road 3	0.12	3.58	0.66	0.01	0.02	0.01	323.76	0.001	0.0001	324
LDGV - Road 5	0.18	4.61	0.70	0.01	0.04	0.01	401.92	0.001	0.0002	402
LDGV - Composite[b]	0.16	4.35	0.69	0.01	0.03	0.01	382.38	0.00	0.00	382.45
HDDV - Road 3	0.03	3.38	0.78	0.00	0.04	0.04	101.04	0.000	0.000	101
HDDV - Road 5	0.02	4.95	0.46	0.00	0.34	0.03	61.00	0.000	0.000	61
HDDV - Composite[b]	0.02	4.56	0.54	0.00	0.26	0.03	71.01	0.00	0.00	71.02
Year 2012										
LDGV - Road 3	0.06	2.23	0.39	0.00	0.02	0.01	321	0.001	0.0001	321
LDGV - Road 5	0.09	2.87	0.41	0.01	0.03	0.01	397	0.001	0.0002	398
LDGV - Composite[b]	0.08	2.71	0.40	0.01	0.03	0.01	378.36	0.00	0.00	378.42
HDDV - Road 3	0.42	2.51	10.25	0.01	0.56	0.50	1,949	0.001	0.001	1,949
HDDV - Road 5	0.66	3.67	12.60	0.02	1.00	0.83	2,426	0.001	0.001	2,427
HDDV - Composite[b]	0.60	3.38	12.01	0.02	0.89	0.74	2,306.87	0.00	0.00	2,307.23
Year 2016 FTU or MOB 1										
LDGV - Road 3	0.03	1.65	0.19	0.00	0.02	0.01	302	0.001	0.0001	302
LDGV - Road 5	0.04	2.11	0.19	0.01	0.03	0.01	374	0.001	0.0002	374
LDGV - Composite[b]	0.04	1.99	0.19	0.01	0.03	0.01	355.79	0.00	0.00	355.85
HDDV - Road 3	0.25	1.57	6.44	0.01	0.36	0.30	1,949	0.001	0.001	1,949
HDDV - Road 5	0.40	2.29	8.00	0.02	0.67	0.51	2,427	0.001	0.001	2,427
HDDV - Composite[b]	0.37	2.11	7.61	0.02	0.59	0.46	2,307.18	0.00	0.00	2,307.54

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Jackson County

[b] Equal to 25/75% road 3/road 5 conditions.

Key: % = percent, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-35. Annual Emissions from Off-Base On-Road Vehicle Activities – Altus AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
LDGV	1.49	39.88	6.33	0.11	0.29	0.12	3,506	0.01	0.00	3,506
HDDV	0.00	0.16	0.02	0.00	0.01	0.00	3	0.00	0.00	3
Total	**1.49**	**40.04**	**6.35**	**0.11**	**0.30**	**0.13**	**3,508**	**0.01**	**0.00**	**3,509**
Year 2012										
LDGV	0.70	23.91	3.53	0.05	0.26	0.10	3,339	0.01	0.00	3,339
HDDV	0.02	0.12	0.42	0.00	0.03	0.03	80	0.00	0.00	80
Total	**0.72**	**24.03**	**3.95**	**0.05**	**0.29**	**0.13**	**3,419**	**0.01**	**0.00**	**3,419**
Year 2016 FTU										
LDGV	0.36	20.37	1.98	0.05	0.30	0.12	3,634	0.01	0.00	3,635
HDDV	0.01	0.08	0.31	0.00	0.02	0.02	93	0.00	0.00	93
Total	**0.38**	**20.45**	**2.28**	**0.06**	**0.33**	**0.14**	**3,727**	**0.01**	**0.00**	**3,728**
Year 2016 MOB 1										
LDGV	0.47	26.24	2.55	0.07	0.39	0.15	4,682	0.01	0.00	4,683
HDDV	0.02	0.11	0.39	0.00	0.03	0.02	119	0.00	0.00	119
Total	**0.49**	**26.35**	**2.94**	**0.07**	**0.42**	**0.18**	**4,802**	**0.01**	**0.00**	**4,802**

Key: CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-36. Nonroad Equipment Usages – Year 2008 Altus AFB

Source	Fuel Type	Hp	Hrs/Yr	Load Factor	Annual Hp-Hrs	Average Hp
Mower	Diesel	27	1,200	55	17,820	4.90
Tractor	Diesel	75	533	70	27,983	6.05
Generator	Diesel	1.9	40	74	56	0.01
Mule	Diesel	12	1,200	49	7,056	2.18
Truck	Diesel	325	167	57	30,937	8.21
Forklift	Diesel	49	120	30	1,764	0.89
Trash	Diesel	454	13	57	3,364	0.89
Garbage	Diesel	210	40	57	4,788	1.27
Mower	Diesel	56	500	55	15,400	4.24
Tractor	Diesel	56	250	70	9,800	2.12
Mower	Diesel	29	900	55	14,355	3.95
Tractor	Diesel	63	6	70	265	0.06
Mower	Diesel	22	150	55	1,815	0.50
Fairway	Diesel	29	900	55	14,355	3.95
Mules	Diesel	16	278	49	2,180	0.67
Mules	Diesel	16	313	49	2,454	0.76
Totals - Diesel Equipment			**6,610**		**154,391**	
Truck	Gasoline	360	800	80	230,400	43.57
Weedeater	Gasoline	1.5	571	68	582	0.13
Blowers	Gasoline	2.5	750	75	1,406	0.28
Trimmers	Gasoline	1.4	10	68	10	0.00
Gator	Gasoline	20	50	46	460	0.15
Truck	Gasoline	240	167	80	32,064	6.06
Sprayer	Gasoline	6.5	200	65	845	0.20
Trash	Gasoline	454	400	80	145,280	27.47
Gator	Gasoline	20	250	46	2,300	0.76
Compressor	Gasoline	5	24	56	67	0.02
Sprayer	Gasoline	7	12	65	55	0.01
Mower	Gasoline	56	500	70	19,600	4.24
Sod	Gasoline	16	5	58	46	0.01
Sprayer	Gasoline	5.5	50	65	179	0.04
Aerator	Gasoline	23	20	58	267	0.07
Greens	Gasoline	22	50	78	858	0.17
Mower	Gasoline	16	400	70	4,480	0.97
Cart	Gasoline	31	250	46	3,565	1.17
Sand	Gasoline	16	220	58	2,042	0.53
Power	Gasoline	7	100	85	595	0.11
Gators	Gasoline	20	200	46	1,840	0.61
ATV	Gasoline	27	375	72	7,290	1.53
ATV	Gasoline	46	375	72	12,420	2.61
EZ	Gasoline	13	333	46	1,991	0.65
Gators	Gasoline	18	455	46	3,767	1.24
Push	Gasoline	6	26	70	109	0.02
Totals - Gasoline Equipment			**6,593**		**472,518**	**93**
Totals - All Equipment			**13,203**		**626,909**	

Key: ATV = All-Terrain Vehicle, Hp = horsepower, hr = hour, yr = year.

Table D.1-37. Annual Average Nonroad Equipment Emission Factors – Altus AFB KC-46A Scenarios

HP Category/ Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008										
41-50 HP Diesel	0.48	2.70	4.90	0.13	0.53	0.49	593	0.094	0.007	597
75-100 HP Gasoline	2.42	72.41	7.06	0.09	0.06	0.06	429	1.69	0.0003	465
Composite[b]	1.78	49.41	6.35	0.10	0.22	0.20	483	1.16	0.00	508
Year 2012										
41-50 HP Diesel	0.50	2.56	4.93	0.13	0.45	0.41	610	0.094	0.007	614
75-100 HP Gasoline	1.31	41.19	3.83	0.08	0.06	0.06	429	1.69	0.0003	465
Composite[b]	1.04	28.44	4.19	0.10	0.19	0.17	489	1.16	0.00	514
Year 2016 FTU or MOB 1										
41-50 HP Diesel	0.32	1.40	3.99	0.11	0.30	0.28	610	0.094	0.007	614
75-100 HP Gasoline	0.71	23.96	1.99	0.08	0.06	0.06	429	1.69	0.0003	465
Composite[b]	0.58	16.52	2.65	0.09	0.14	0.13	489	1.16	0.00	514

Table D.1-37. Annual Average Nonroad Equipment Emission Factors – Altus AFB KC-46A Scenarios (Continued)

HP Category/ Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Year 2008										
41-50 HP Diesel	0.036	0.006	0.010	0.001	–	–	–	–	–	–
75-100 HP Gasoline	0.010	0.002	0.127	0.002	–	–	–	–	–	–
Composite[b]	0.018	0.003	0.088	0.002	–	–	–	–	–	–
Year 2012										
41-50 HP Diesel	0.037	0.006	0.010	0.001	–	–	–	–	–	–
75-100 HP Gasoline	0.005	0.001	0.069	0.001	–	–	–	–	–	–
Composite[b]	0.016	0.003	0.049	0.001	–	–	–	–	–	–
Year 2016 FTU or MOB 1										
41-50 HP Diesel	0.024	0.004	0.006	0.001	–	–	–	–	–	–
75-100 HP Gasoline	0.003	0.000	0.037	0.001	–	–	–	–	–	–
Composite[b]	0.010	0.002	0.027	0.001	–	–	–	–	–	–

HP Category/ Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphtha-lene*	*Phenol*
Year 2008										
41-50 HP Diesel	–	–	0.001	0.072	0.001	–	–	–	–	–
75-100 HP Gasoline	–	–	0.048	0.028	0.024	–	–	0.387	–	–
Composite[b]	–	–	0.033	0.043	0.016	–	–	0.260	–	–
Year 2012										
41-50 HP Diesel	–	–	0.002	0.075	0.001	–	–	–	–	–
75-100 HP Gasoline	–	–	0.026	0.015	0.013	–	–	0.210	–	–
Composite[b]	–	–	0.018	0.035	0.009	–	–	0.141	–	–
Year 2016 FTU or MOB 1										
41-50 HP Diesel	–	–	0.001	0.048	0.001	–	–	–	–	–
75-100 HP Gasoline	–	–	0.014	0.008	0.007	–	–	0.114	–	–
Composite[b]	–	–	0.010	0.021	0.005	–	–	0.076	–	–

HP Category/ Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2008										
41-50 HP Diesel	0.000	0.005	0.000	–	–	0.007	–	–	–	0.005
75-100 HP Gasoline	0.000	0.992	0.002	–	–	0.174	–	–	–	0.164
Composite[b]	0.000	0.666	0.001	–	–	0.119	–	–	–	0.112
Year 2012										
41-50 HP Diesel	0.000	0.005	0.000	–	–	0.008	–	–	–	0.005
75-100 HP Gasoline	0.000	0.537	0.001	–	–	0.094	–	–	–	0.089
Composite[b]	0.000	0.361	0.001	–	–	0.065	–	–	–	0.061
Year 2016 FTU or MOB 1										
41-50 HP Diesel	0.000	0.003	0.000	–	–	0.005	–	–	–	0.003
75-100 HP Gasoline	0.000	0.291	0.001	–	–	0.051	–	–	–	0.048
Composite[b]	0.000	0.196	0.000	–	–	0.036	–	–	–	0.033

[a] Data estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Jackson County, OK.

[b] Assumes a vehicle fleet mix of 0.33/0.67 diesel/gasoline-powered equipment = 2008 fleet mix.

Key: – = Source does not emit particular pollutant, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, Hp = horsepower, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, OK = Oklahoma, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-38. Annual Emissions from Nonroad Equipment Activities – Altus AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2008	14.70	201.00	4.90	0.50	0.40	0.40	2,340	5.64	0.01	2,462
Year 2012	8.29	111.38	3.12	0.45	0.34	0.34	2,279	5.43	0.01	2,396
Year 2016 FTU	5.35	74.86	2.28	0.49	0.29	0.29	2,639	6.29	0.01	2,775
Year 2016 MOB 1	6.89	96.45	2.94	0.63	0.37	0.37	3,400	8.10	0.02	3,575

Scenario Year/ Source Type	Tons per Year									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Buta-diene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Year 2008	0.013	0.002	0.061	0.001	–	–	–	–	–	–
Year 2012	0.011	0.002	0.033	0.001	–	–	–	–	–	–
Year 2016 FTU	0.008	0.001	0.021	0.000	–	–	–	–	–	–
Year 2016 MOB 1	0.010	0.002	0.027	0.001	–	–	–	–	–	–

Scenario Year/ Source Type	Tons per Year									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methyl-ene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Year 2008	–	–	0.023	0.029	0.011	–	–	0.179	–	–
Year 2012	–	–	0.012	0.023	0.006	–	–	0.093	–	–
Year 2016 FTU	–	–	0.008	0.016	0.004	–	–	0.059	–	–
Year 2016 MOB 1	–	–	0.010	0.021	0.005	–	–	0.076	–	–

Scenario Year/ Source Type	Tons per Year									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2008	0.000	0.460	0.001	–	–	0.082	–	–	–	0.077
Year 2012	0.000	0.240	0.001	–	–	0.044	–	–	–	0.041
Year 2016 FTU	0.000	0.151	0.000	–	–	0.028	–	–	–	0.026
Year 2016 MOB 1	0.000	0.195	0.000	–	–	0.035	–	–	–	0.033

Note: Future year emissions = 2008 emissions * future scenario worker fraction of 2008 * future scenario year vehicle emission factor/ 2008 vehicle emission factor.

Key: – = Source does not emit particular pollutant; CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-39. Annual Emissions from Mobile Fuel Transfer Activities – Altus AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*Benzene*	*Cumene*	*Ethyl benzene*	*Hexane*	*MTBE*	*Naphth-alene*	*Toluene*	*2,2,4-Tri-methyl-pentane*	*Xylenes*
Year 2008	0.10	0.0006	0.0003	0.0002	0.0001	0.0005	0.0000	0.0011	0.0001	0.0017
Year 2012	0.09	0.0006	0.0003	0.0002	0.0001	0.0005	0.0000	0.0010	0.0001	0.0016
Year 2016 FTU	0.11	0.0007	0.0003	0.0003	0.0001	0.0005	0.0000	0.0012	0.0001	0.0018
Year 2016 MOB 1	0.14	0.0009	0.0004	0.0003	0.0001	0.0007	0.0000	0.0016	0.0001	0.0024

Note: Future year emissions = 2008 emissions * future year worker fraction of 2008.

Key: CO = carbon monoxide, CO_2 = carbon dioxide, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-40. Annual Emissions from Point and Area Sources – Altus AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	***CO***	***NO_x***	***SO_2***	***PM_{10}***	***$PM_{2.5}$***	***CO_2***	***CH_4***	***N_2O***	***CO_2e***
Year 2008	1.98	6.08	10.02	0.18	1.09	0.49	–	–	–	–
Year 2012	1.91	5.85	9.65	0.17	1.05	0.47	–	–	–	–
Year 2016 FTU	2.21	6.77	11.16	0.20	1.21	0.54	–	–	–	–
Year 2016 MOB 1	2.84	8.73	14.38	0.26	1.56	0.70	–	–	–	–

Scenario Year/ Source Type	Tons per Year									
	Acetalde-hyde	***Acrolein***	***Benzene***	***1,3-Buta-diene***	***Carbon Disulfide***	***Carbon Tetra-chloride***	***Chloro-form***	***Chloro-methane***	***Dibutyl Phthalate***	***1,2-Dichloro-propane***
Year 2008	–	–	–	–	–	–	–	–	–	–
Year 2012	–	–	–	–	–	–	–	–	–	–
Year 2016 FTU	–	–	–	–	–	–	–	–	–	–
Year 2016 MOB 1	–	–	–	–	–	–	–	–	–	–

Scenario Year/ Source Type	Tons per Year									
	2,4-Dinitro-phenol	***DEHP***	***Ethyl-benzene***	***Formalde-hyde***	***Hexane***	***Methanol***	***Methyl-ene Chloride***	***MTBE***	***Naphth-alene***	***Phenol***
Year 2008	–	–	–	–	0.116	–	–	–	–	–
Year 2012	–	–	–	–	0.11	–	–	–	–	–
Year 2016 FTU	–	–	–	–	0.13	–	–	–	–	–
Year 2016 MOB 1	–	–	–	–	0.17	–	–	–	–	–

Scenario Year/ Source Type	Tons per Year									
	POM	***Propio-nalde-hyde***	***Styrene***	***1,1,2,2-Tetra-chloro-ethane***	***Tetra-chloro-ethene***	***Toluene***	***1,1,1-Trichloro-ethane***	***Vinyl Acetate***	***mp-Xylene***	***o-Xylene***
Year 2008	–	–	–	–	–	0.008	–	–	–	0.008
Year 2012	–	–	–	–	–	0.01	–	–	–	0.01
Year 2016 FTU	–	–	–	–	–	0.01	–	–	–	0.01
Year 2016 MOB 1	–	–	–	–	–	0.01	–	–	–	0.01

Note: Future year emissions = 2008 emissions * future year worker fraction of 2008.

Key: – = Source does not emit particular pollutant, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-41. Annual Emissions for Operations at Altus AFB – Year 2008

Source Type	Tons per Year									
	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
C-17 Aircraft Operations	87.74	794.00	2,745.60	232.00	686.68	686.68	425,379	11.772	13.227	429,726
KC-135 Aircraft Operations	13.10	525.00	713.00	121.00	176.00	176.00	221,857	6.140	6.899	224,125
Transient Aircraft Operations	0.79	2.90	1.80	0.18	0.44	0.44	330	0.009	0.010	333
On-Wing Aircraft Engine Testing - C-17	10.90	120.00	35.40	9.40	54.10	54.10	17,235	0.477	0.536	17,411
On-Wing Aircraft Engine Testing - KC-135	4.30	126.00	25.20	8.70	42.50	42.50	15,952	0.441	0.496	16,115
Aerospace Ground Support Equipment	5.70	15.30	71.00	4.70	5.04	5.00	15,753	2.61	0.19	15,864.93
Government Motor Vehicles	0.13	3.50	1.57	0.52	1.90	0.50	345	–	–	–
Privately-Owned Vehicles - On-Base	1.90	31.30	2.30	0.28	2.75	0.77	1,416	–	–	–
Privately-Owned Vehicles - Off-Base	1.49	40.04	6.35	0.11	0.30	0.13	3,508	–	–	–
Nonroad Equipment	14.70	201.00	4.90	0.50	0.40	0.40	2,340	5.64	0.01	2,462.34
Mobile Fuel Transfer Operations	0.10	–	–	–	–	–	–	–	–	–
Point and Area Sources	1.98	6.08	10.02	0.18	1.09	0.49	–	–	–	–
Total Emissions[a]	**142.82**	**1,865.12**	**3,617.14**	**377.57**	**971.20**	**967.00**	**704,115**	**27.09**	**21.37**	**706,038**

Source Type	Tons per Year							
	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Chloromethane
C-17 Aircraft Operations	0.318	–	0.675	–	0.025	–	0.122	0.018
KC-135 Aircraft Operations	–	–	0.170	–	–	0.020	0.264	0.107
Transient Aircraft Operations	0.002	0.002	0.003	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.040	–	0.084	–	0.003	–	0.015	0.002
On-Wing Aircraft Engine Testing - KC-135	–	–	0.056	–	-	0.007	0.087	0.035
Aerospace Ground Support Equipment	0.014	0.002	0.060	0.009	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	0.013	0.002	0.061	0.001	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.001	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–
Total Emissions[a]	**0.39**	**0.01**	**1.11**	**0.01**	**0.03**	**0.03**	**0.49**	**0.16**

Source Type	Tons per Year							
	Cumene	Dibutyl Phthalate	1,2-Dichloropropane	2,4-Dinitrophenol	DEHP	Ethylbenzene	Formaldehyde	Hexane
C-17 Aircraft Operations	–	0.067	0.167	0.665	0.270	0.075	7.574	–
KC-135 Aircraft Operations	–	–	–	–	0.631	0.047	6.905	–
Transient Aircraft Operations	–	–	–	–	–	0.000	0.012	–
On-Wing Aircraft Engine Testing - C-17	–	0.008	0.021	0.083	0.034	0.009	0.941	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	0.207	0.015	2.267	–
Aerospace Ground Support Equipment	–	–	–	–	–	0.018	0.027	0.009
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	–	–	–	0.023	0.029	0.011
Mobile Fuel Transfer Operations	0.000	–	–	–	–	0.000	–	0.000
Point and Area Sources	–	–	–	–	–	–	–	0.116
Total Emissions[a]	**0.00**	**0.08**	**0.19**	**0.75**	**1.14**	**0.19**	**17.75**	**0.14**

Table D.1-41. Annual Emissions for Operations at Altus AFB – Year 2008 (Continued)

Source Type	Tons per Year							
	Methanol	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propio-naldehyde*	*Styrene*
C-17 Aircraft Operations	–	0.430	–	0.063	0.100	–	–	0.041
KC-135 Aircraft Operations	–	7.108	–	0.199	–	–	–	0.101
Transient Aircraft Operations	–	–	–	0.001	–	–	–	0.001
On-Wing Aircraft Engine Testing - C-17	–	0.053	–	0.008	0.012	–	–	0.005
On-Wing Aircraft Engine Testing - KC-135	–	2.333	–	0.065	–	–	–	0.033
Aerospace Ground Support Equipment	–	–	0.140	0.001	–	0.002	0.002	0.001
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	0.179	–	–	0.000	0.460	0.001
Mobile Fuel Transfer Operations	–	–	0.000	0.000	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–
Total Emissions[a]	**–**	**9.92**	**0.32**	**0.34**	**0.11**	**0.00**	**0.46**	**0.18**

Source Type	Tons per Year							
	1,1,2,2-Tetrachloro-ethane	*Tetrachloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*2,2,4-Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
C-17 Aircraft Operations	0.232	–	0.310	0.016	–	–	0.123	0.026
KC-135 Aircraft Operations	–	0.170	0.702	0.058	–	0.497	0.145	–
Transient Aircraft Operations	–	–	0.002	–	–	–	–	0.001
On-Wing Aircraft Engine Testing - C-17	0.029	–	0.038	0.002	–	–	0.015	0.003
On-Wing Aircraft Engine Testing - KC-135	–	0.056	0.231	0.019	–	0.163	0.048	–
Aerospace Ground Support Equipment	–	–	0.070	–	–	–	–	0.065
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	0.082	–	–	–	–	0.077
Mobile Fuel Transfer Operations	–	–	0.001	–	0.000	–	–	0.002
Point and Area Sources	–	–	0.008	–	–	–	–	0.008
Total Emissions[a]	**0.26**	**0.23**	**1.44**	**0.09**	**0.00**	**0.66**	**0.33**	**0.18**

[a] Data from 2008 Mobile Source Air Emissions Inventory for Altus Air Force Base (Weston Solutions, Inc. 2008), except point and area sources obtained from 2008 Air Emissions Inventory Turn – Around Document (ODEQ 2010) and Off-Base POV emissions calculated with the use of typical trip lengths. However, CO_2 emissions estimated with widely acceptable factors.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, POV = privately-owned vehicle, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-42. Annual Emissions for Existing Operations at Altus AFB – Year 2012

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
C-17 Aircraft Operations	25.92	234.56	811.10	68.54	202.86	202.86	125,665	3.48	3.91	115,409
KC-135 Aircraft Operations	3.87	155.10	210.64	35.75	52.00	52.00	65,544	1.81	2.04	60,195
Transient Aircraft	1.38	5.07	3.15	0.31	0.77	0.77	577	0.02	0.02	530
On-Wing Aircraft Engine Testing - C-17	10.90	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.16	7.77	9.77	0.64	4.24	4.24	1,956	0.05	0.06	1,796
On-Wing Aircraft Engine Testing - KC-135	0.99	14.32	7.07	0.82	0.05	0.05	2,481	0.07	0.08	2,278
Aerospace Ground Support Equipment	0.84	6.08	7.11	0.20	0.94	0.86	5,181	0.80	0.06	4,741
Government Motor Vehicles	0.11	0.98	2.34	0.00	0.13	0.11	487	0.00	0.00	443
Privately-Owned Vehicles - On-Base	0.23	8.09	1.49	0.02	0.07	0.04	1,198	0.00	0.00	1,089
Privately-Owned Vehicles - Off-Base	0.72	24.03	3.95	0.05	0.29	0.13	3,419	0.01	0.00	3,109
Nonroad Equipment	8.29	111.38	3.12	0.45	0.34	0.34	2,279	5.43	0.01	2,178
Mobile Fuel Transfer Operations	0.09	–	–	–	–	–	–	–	–	–
Point and Area Sources	1.91	5.85	9.65	0.17	1.05	0.47	–	–	–	–
Total Emissions	**55.39**	**573.25**	**1,069.38**	**106.96**	**262.74**	**261.86**	**208,787**	**11.67**	**6.17**	**191,769**

Source Type	Tons per Year							
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*
C-17 Aircraft Operations	0.094	–	0.199	–	0.007	–	0.036	0.005
KC-135 Aircraft Operations	–	–	0.050	–	–	0.006	0.078	0.032
Transient Aircraft	0.003	0.004	0.006	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.004	–	0.008	–	0.000	–	0.001	0.000
On-Wing Aircraft Engine Testing - KC-135	–	–	0.001	–	–	0.000	0.001	0.001
Aerospace Ground Support Equipment	0.002	0.000	0.009	0.001	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	0.011	0.002	0.033	0.001	–	–	–	–
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–
Total Emissions	**0.114**	**0.006**	**0.307**	**0.002**	**0.007**	**0.006**	**0.116**	**0.037**

Source Type	Tons per Year							
	Cumene	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*
C-17 Aircraft Operations	–	0.020	0.049	0.197	0.080	0.022	2.237	–
KC-135 Aircraft Operations	–	–	–	–	0.186	0.014	2.040	–
Transient Aircraft	–	–	–	–	–	0.001	0.021	–
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	–	0.000	0.001	0.003	0.001	0.001	0.083	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	0.003	0.000	0.046	–
Aerospace Ground Support Equipment	–	–	–	–	–	0.003	0.004	0.001
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	–	–	–	0.012	0.023	0.006
Mobile Fuel Transfer Operations	0.000	–	–	–	–	0.000	–	0.000
Point and Area Sources	–	–	–	–	–	–	–	0.112
Total Emissions	**0.000**	**0.020**	**0.050**	**0.200**	**0.271**	**0.053**	**4.454**	**0.119**

Table D.1-42. Annual Emissions for Existing Operations at Altus AFB – Year 2012 (Continued)

Source Type	Tons per Year							
	Methanol	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propio-naldehyde*	*Styrene*
C-17 Aircraft Operations	–	0.127	–	0.019	0.030	–	–	0.012
KC-135 Aircraft Operations	–	2.100	–	0.059	–	–	–	0.030
Transient Aircraft	–	–	–	0.002	–	–	–	0.001
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	
On-Wing Aircraft Engine Testing - C-17	–	0.002	–	0.001	0.001	–	–	0.001
On-Wing Aircraft Engine Testing - KC-135	–	0.036	–	0.001	–	–	–	0.001
Aerospace Ground Support Equipment	–	–	0.021	0.000	–	0.000	0.000	0.000
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	0.093	–	–	0.000	0.240	0.001
Mobile Fuel Transfer Operations	–	–	0.000	0.000	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–
Total Emissions	–	**2.265**	**0.114**	**0.081**	**0.031**	**0.000**	**0.241**	**0.045**

Source Type	Tons per Year							
	1,1,2,2-Tetrachloro-ethane	*Tetrachloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*2,2,4-Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
C-17 Aircraft Operations	0.069	–	0.092	0.005	–	–	0.036	0.008
KC-135 Aircraft Operations	–	0.050	0.207	0.017	–	0.147	0.043	–
Transient Aircraft	–	–	0.003	–	–	–	–	0.002
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.001	–	0.003	0.000	–	–	0.001	0.000
On-Wing Aircraft Engine Testing - KC-135	–	0.001	0.005	0.000	–	0.003	0.001	–
Aerospace Ground Support Equipment	–	–	0.010	–	–	–	–	0.010
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	0.044	–	–	–	–	0.041
Mobile Fuel Transfer Operations	–	–	0.001	–	0.000	–	–	0.002
Point and Area Sources	–	–	0.008	–	–	–	–	0.008
Total Emissions	**0.070**	**0.051**	**0.372**	**0.022**	**0.000**	**0.150**	**0.081**	**0.070**

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, mt = metric tons, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-43. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at Altus AFB – Year 2016

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
KC-46A Aircraft Operations	34.63	157.55	1,034.50	54.09	3.35	2.84	163,451	4.52	5.08	150,110
On-Wing Aircraft Engine Testing - KC-46A	14.14	48.41	23.62	1.88	0.17	0.15	5,690	0.16	0.18	5,226
Aerospace Ground Support Equipment - KC-46A	0.13	0.98	1.11	0.04	0.16	0.15	1,199	0.19	0.00	1,094
C-17 Aircraft Operations	25.92	234.56	811.10	68.54	202.86	202.86	125,665	3.48	3.91	115,409
KC-135 Aircraft Operations	3.87	155.10	210.64	35.75	52.00	52.00	65,544	1.81	2.04	60,195
Transient Aircraft	1.38	5.07	3.15	0.31	0.77	0.77	577	0.02	0.02	530
On-Wing Aircraft Engine Testing - C-17	0.16	7.77	9.77	0.64	4.24	4.24	1,956	0.05	0.06	1,633
On-Wing Aircraft Engine Testing - KC-135	0.99	14.32	7.07	0.82	0.05	0.05	2,481	0.07	0.08	2,071
Aerospace Ground Support Equipment - Existing Aircraft	0.59	4.27	4.83	0.19	0.71	0.65	5,181	0.80	0.06	4,741
Government Motor Vehicles	0.08	0.79	1.70	0.00	0.09	0.08	561	0.00	0.00	510
Privately-Owned Vehicles - On-Base	0.13	6.91	0.87	0.02	0.08	0.04	1,307	0.00	0.00	1,189
Privately-Owned Vehicles - Off-Base	0.38	20.45	2.28	0.06	0.33	0.14	3,727	0.01	0.00	3,389
Nonroad Equipment	5.35	74.86	2.28	0.49	0.29	0.29	2,639	6.29	0.01	2,523
Mobile Fuel Transfer Operations	0.11	–	–	–	–	–	–	–	–	–
Point and Area Sources	2.21	6.77	11.16	0.20	1.21	0.54	–	–	–	–
Total Proposed Emissions - 2016	**90.06**	**737.82**	**2,124.08**	**163.02**	**266.31**	**264.79**	**379,978**	**17.39**	**11.43**	**348,618**
Year 2012 Base Case Emissions	**(55.39)**	**(573.25)**	**(1,069.38)**	**(106.96)**	**(262.74)**	**(261.86)**	**(208,787)**	**(11.67)**	**(6.17)**	**(191,769)**
Proposed Year 2016 minus Base Case Emissions	**34.67**	**164.57**	**1,054.70**	**56.06**	**3.58**	**2.93**	**171,191**	**5.72**	**5.26**	**156,850**
Jackson County PSD Thresholds	**250**	**250**	**250**	**250**	**250**	**250**	**–**	**–**	**–**	**–**
Proposed Fractional Increase from Altus 2012 Emissions	**0.63**	**0.29**	**0.99**	**0.52**	**0.01**	**0.01**	**0.82**	**0.49**	**0.85**	**0.82**

Source Type	Tons per Year							
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*
KC-46A Aircraft Operations	1.492	0.856	0.587	0.589	–	–	–	–
On-Wing Aircraft Engine Testing - KC-46A	0.608	0.349	0.239	0.240	–	–	–	–
Aerospace Ground Support Equipment - KC-46A	0.000	0.000	0.001	0.000	–	–	–	–
C-17 Aircraft Operations	0.094	–	0.199	–	0.007	–	0.036	0.005
KC-135 Aircraft Operations	–	–	0.050	–	–	0.006	0.078	0.032
Transient Aircraft	0.003	0.004	0.006	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.004	–	0.008	–	0.000	–	0.001	0.000
On-Wing Aircraft Engine Testing - KC-135	–	–	0.001	–	–	0.000	0.001	0.001
Aerospace Ground Support Equipment - Existing Aircraft	0.001	0.000	0.006	0.001	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	0.008	0.001	0.021	0.000	–	–	–	–
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**2.21**	**1.21**	**1.12**	**0.83**	**0.007**	**0.01**	**0.12**	**0.04**
Year 2012 Base Case Emissions	**(0.114)**	**(0.006)**	**(0.307)**	**(0.002)**	**(0.007)**	**(0.006)**	**(0.116)**	**(0.037)**
Proposed Year 2016 minus Base Case Emissions	**2.097**	**1.204**	**0.813**	**0.829**	**–**	**–**	**–**	**–**
Jackson County PSD Thresholds	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Proposed Fractional Increase from Altus 2012 Emissions	**18.41**	**211.60**	**2.65**	**395.79**	**–**	**–**	**–**	**–**

Table D.1-43. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at Altus AFB – Year 2016 (Continued)

Source Type	Tons per Year						
	Cumene	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*
KC-46A Aircraft Operations	–	–	–	–	–	0.061	4.300
On-Wing Aircraft Engine Testing - KC-46A	–	–	–	–	–	0.025	1.752
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	0.000	0.001
C-17 Aircraft Operations	–	0.020	0.049	0.197	0.080	0.022	2.237
KC-135 Aircraft Operations	–	–	–	–	0.186	0.014	2.040
Transient Aircraft	–	–	–	–	–	0.001	0.021
On-Wing Aircraft Engine Testing - C-17	–	–	0.000	0.001	0.003	0.001	0.001
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	0.003	0.000
Aerospace Ground Support Equipment - Existing Aircraft	–	–	–	–	–	0.002	0.003
Government Motor Vehicles	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Nonroad Equipment	–	–	–	–	–	0.008	0.016
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**–**	**0.02**	**0.05**	**0.20**	**0.27**	**0.14**	**10.37**
Year 2012 Base Case Emissions	**–**	**(0.020)**	**(0.050)**	**(0.200)**	**(0.271)**	**(0.053)**	**(4.454)**
Proposed Year 2016 minus Base Case Emissions	**–**	**(0.000)**	**(0.001)**	**(0.003)**	**(0.001)**	**0.084**	**5.917**
Jackson County PSD Thresholds	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Proposed Fractional Increase from Altus 2012 Emissions	**–**	**(0.02)**	**(0.01)**	**(0.01)**	**(0.00)**	**1.60**	**1.33**

Source Type	Tons per Year							
	Hexane	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propio-nalde-hyde*
KC-46A Aircraft Operations	–	0.631	–	–	0.189	0.254	–	–
On-Wing Aircraft Engine Testing - KC-46A	–	0.257	–	–	0.077	0.103	–	–
Aerospace Ground Support Equipment - KC-46A	0.000	–	–	0.003	0.000	–	0.000	0.000
C-17 Aircraft Operations	–	–	0.127	–	0.019	0.030	–	–
KC-135 Aircraft Operations	–	–	2.100	–	0.059	–	–	–
Transient Aircraft	–	–	–	–	0.002	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.083	–	–	0.002	–	0.001	0.001	–
On-Wing Aircraft Engine Testing - KC-135	0.046	–	–	0.036	–	0.001	–	–
Aerospace Ground Support Equipment - Existing Aircraft	0.001	–	–	0.014	0.000	–	0.000	0.000
Government Motor Vehicles	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–
Nonroad Equipment	0.004	–	–	0.059	–	–	0.000	0.151
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–
Point and Area Sources	0.129	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.26**	**0.89**	**2.23**	**0.11**	**0.35**	**0.39**	**0.00**	**0.15**
Year 2012 Base Case Emissions	**(0.119)**	**–**	**(2.265)**	**(0.114)**	**(0.081)**	**(0.031)**	**(0.000)**	**(0.241)**
Proposed Year 2016 minus Base Case Emissions	**0.144**	**0.888**	**(0.038)**	**(0.000)**	**0.264**	**0.358**	**0.001**	**(0.090)**
Jackson County PSD Thresholds	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Proposed Fractional Increase from Altus 2012 Emissions	**1.21**	**–**	**(0.02)**	**(0.00)**	**3.24**	**11.56**	**3.50**	**(0.37)**

Table D.1-43. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at Altus AFB – Year 2016 (Continued)

Source Type	Tons per Year								
	Styrene	*1,1,2,2-Tetrachloroethane*	*Tetrachloroethene*	*Toluene*	*1,1,1-Trichloroethane*	*2,2,4-Trimethylpentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-46A Aircraft Operations	0.108	–	–	0.224	–	–	–	0.099	0.058
On-Wing Aircraft Engine Testing - KC-46A	0.044	–	–	0.091	–	–	–	0.040	0.024
Aerospace Ground Support Equipment - KC-46A	0.000	–	–	0.002	–	–	–	–	0.002
C-17 Aircraft Operations	0.012	0.069	–	0.092	0.005	–	–	0.036	0.008
KC-135 Aircraft Operations	0.030	–	0.050	0.207	0.017	–	0.147	0.043	–
Transient Aircraft	0.001	–	–	0.003	–	–	–	–	0.002
On-Wing Aircraft Engine Testing - C-17	–	0.001	0.001	–	0.003	–	0.000	–	–
On-Wing Aircraft Engine Testing - KC-135	–	0.001	–	0.001	0.005	–	0.000	–	0.003
Aerospace Ground Support Equipment - Existing Aircraft	0.000	–	–	0.007	–	–	–	–	0.007
Government Motor Vehicles	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–
Nonroad Equipment	0.000	–	–	0.028	–	–	–	–	0.026
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	0.009	–	–	–	–	0.009
Total Proposed Emissions - 2016	**0.20**	**0.07**	**0.05**	**0.66**	**0.03**	**–**	**0.15**	**0.22**	**0.14**
Year 2012 Base Case Emissions	**(0.045)**	**(0.070)**	**(0.051)**	**(0.372)**	**(0.022)**	**–**	**(0.150)**	**(0.081)**	**(0.070)**
Proposed Year 2016 minus Base Case Emissions	**0.151**	**(0.000)**	**0.000**	**0.292**	**0.007**	**–**	**(0.003)**	**0.137**	**0.068**
Jackson County PSD Thresholds	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Proposed Fractional Increase from Altus 2012 Emissions	**3.37**	**(0.00)**	**0.00**	**0.79**	**0.30**	**–**	**(0.02)**	**1.69**	**0.97**

Key: ( ) = parenthesis indicate negative numbers, – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, mt = metric tons, NA = not applicable, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-44. KC-135/KC-46A Aircraft Operations at Clinton Sherman Industrial Airpark – Altus AFB KC-46A FTU Scenario

Scenario/Operation	*Operations/ Year*	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	*60%*	*Climbout*	*Takeoff*	*55%*	*60%*	*Climbout*	*Takeoff*
Existing KC-135 [a]									
Closed Pattern - IFR	1,062	12.0	2.0	–	1.0	212	35	–	18
Closed Pattern - VFR	434	5.0	2.0	–	1.0	36	14	–	7
Total TIMs - Existing KC-135						**249**	**50**	**–**	**25**
KC-46A - FTU [a]									
Closed Pattern - Radar & Initial to Overhead	1,062	12.0	2.0	–	1.0	212	35	–	18
Closed Pattern - VFR	434	5.0	2.0	–	1.0	36	14	–	7
Total TIMs - KC-46A FTU						**249**	**50**	**–**	**25**

[a] Source is SAIC 2013d.

Key: – = No activity, % = percent, FTU = Formal Training Unit, IFR = instrument flight rules, TIM = Time in Mode, VFR = visual flight rules.

Table D.1-45. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Clinton Sherman Industrial Airpark – Altus AFB KC-46A FTU Scenario

Scenario/Engine Setting	Annual Emissions - Tons										
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*	*CO_2e (mt)*
Existing KC-135											
55%	0.16	4.98	25.06	2.26	0.12	0.12	6,862	0.19	0.21	6,932	–
60%	0.03	0.91	5.79	0.49	0.03	0.03	1,494	0.04	0.05	1,509	–
Take-off	0.02	0.04	7.20	0.41	0.03	0.03	1,251	0.03	0.04	1,264	–
Subtotal Existing KC-135	**0.21**	**5.92**	**38.04**	**3.17**	**0.17**	**0.17**	**9,607**	**0.27**	**0.30**	**9,705**	–
KC-46A - FTU											
55%	0.25	3.43	49.42	2.84	0.16	0.13	8,616	0.24	0.27	8,704	–
60%	0.05	0.68	11.59	0.62	0.04	0.03	1,891	0.05	0.06	1,911	–
Take-off	0.05	0.33	18.52	0.57	0.04	0.04	1,734	0.05	0.05	1,751	–
Subtotal KC-46A FTU	**0.35**	**4.43**	**79.53**	**4.03**	**0.24**	**0.20**	**12,241**	**0.34**	**0.38**	**12,366**	**11,242**

Scenario/Engine Setting	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Existing KC-135										
55%	–	–	0.004	–	–	0.001	0.004	0.002	–	–
60%	–	–	0.001	–	–	0.000	0.001	0.000	–	–
Take-off	–	–	0.000	–	–	-	0.000	0.000	–	–
Subtotal Existing KC-135	–	–	**0.005**	–	–	**0.001**	**0.005**	**0.002**	–	–
KC-46A - FTU										
55%	0.011	0.006	0.004	0.004	–	–	–	–	–	–
60%	0.002	0.001	0.001	0.001	–	–	–	–	–	–
Take-off	0.002	0.001	0.001	0.001	–	–	–	–	–	–
Subtotal KC-46A FTU	**0.015**	**0.009**	**0.006**	**0.006**	–	–	–	–	–	–

Scenario/Engine Setting	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Existing KC-135										
55%	–	0.006	0.001	0.023	–	–	0.101	–	–	–
60%	–	0.001	0.000	0.005	–	–	0.022	–	–	–
Take-off	–	0.001	-	0.003	–	–	0.001	–	–	–
Subtotal Existing KC-135	–	**0.008**	**0.001**	**0.030**	–	–	**0.124**	–	–	–
KC-46A - FTU										
55%	–	–	0.000	0.031	–	0.005	–	–	0.001	0.002
60%	–	–	0.000	0.007	–	0.001	–	–	0.000	0.000
Take-off	–	–	0.000	0.006	–	0.001	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.001**	**0.044**	–	**0.006**	–	–	**0.002**	**0.003**

Scenario/Engine Setting	Annual Emissions - Tons									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Existing KC-135										
55%	–	–	–	–	0.004	0.009	0.001	0.007	0.002	–
60%	–	–	–	–	0.001	0.002	0.000	0.001	0.000	–
Take-off	–	–	–	–	0.000	0.000	0.000	0.001	0.000	–
Subtotal Existing KC-135	–	–	–	–	**0.005**	**0.011**	**0.001**	**0.009**	**0.003**	–
KC-46A - FTU										
55%	–	–	0.001	–	–	0.002	–	–	0.001	0.000
60%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.001**	–	–	**0.002**	–	–	**0.001**	**0.001**

Key: – = Source does not emit particular pollutant, % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-46. KC-135/KC-46A Aircraft Operations at Rick Husband Amarillo International Airport – Altus AFB KC-46A FTU Scenario

Scenario/ Operation	Operations per Year	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	*60%*	*Climbout*	*Takeoff*	*55%*	*60%*	*Climbout*	*Takeoff*
Existing KC-135 [a]									
Closed Pattern - IFR	137	12.0	2.0	–	1.0	27	5	–	2
Closed Pattern - VFR	92	5.0	2.0	–	1.0	8	3	–	2
Total TIMs - Existing KC-135						**35**	**8**	–	**4**
KC-46A - FTU [a]									
Closed Pattern - Radar & Initial to Overhead	137	12.0	2.0	–	1.0	27	5	–	2
Closed Pattern - VFR	92	5.0	2.0	–	1.0	8	3	–	2
Total TIMs - KC-46A FTU						**35**	**8**	–	**4**

[a] Source is SAIC 2013b.

Key: – = Source does not emit particular pollutant, % = percent, FTU = Formal Training Unit, IFR = instrument flight rules, TIM = Time in Mode, VFR = visual flight rules.

Table D.1-47. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Rick Husband Amarillo International Airport – Altus AFB KC-46A FTU Scenario

Scenario/ Engine Setting	Annual Emissions - Tons										
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*	*CO_2e (mt)*
Existing KC-135											
55%	0.02	0.70	3.54	0.32	0.02	0.02	969	0.03	0.03	979	–
60%	0.01	0.14	0.89	0.08	0.00	0.00	229	0.01	0.01	231	–
Take-off	0.00	0.01	1.10	0.06	0.00	0.00	192	0.01	0.01	193	–
Subtotal Existing KC-135	**0.03**	**0.85**	**5.53**	**0.46**	**0.02**	**0.02**	**1,390**	**0.04**	**0.04**	**1,404**	–
KC-46A - FTU											
55%	0.04	0.48	6.98	0.40	0.02	0.02	1,217	0.03	0.04	1,230	–
60%	0.01	0.10	1.77	0.10	0.01	0.00	290	0.01	0.01	292	–
Take-off	0.01	0.05	2.84	0.09	0.01	0.01	265	0.01	0.01	268	–
Subtotal KC-46A FTU	**0.05**	**0.64**	**11.59**	**0.58**	**0.03**	**0.03**	**1,772**	**0.05**	**0.06**	**1,790**	**1,627**

Scenario/ Engine Setting	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Existing KC-135										
55%	–	–	0.001	–	–	0.000	0.001	0.000	–	–
60%	–	–	0.000	–	–	0.000	0.000	0.000	–	–
Take-off	–	–	0.000	–	–	–	0.000	0.000	–	–
Subtotal Existing KC-135	–	–	**0.001**	–	–	**0.000**	**0.001**	**0.000**	–	–
KC-46A - FTU										
55%	0.002	0.001	0.001	0.001	–	–	–	–	–	–
60%	0.000	0.000	0.000	0.000	–	–	–	–	–	–
Take-off	0.000	0.000	0.000	0.000	–	–	–	–	–	–
Subtotal KC-46A FTU	**0.002**	**0.001**	**0.001**	**0.001**	–	–	–	–	–	–

Scenario/ Engine Setting	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Existing KC-135										
55%	–	0.001	0.000	0.003	–	–	0.014	–	–	–
60%	–	0.000	0.000	0.001	–	–	0.003	–	–	–
Take-off	–	0.000	–	0.000	–	–	0.000	–	–	–
Subtotal Existing KC-135	–	**0.001**	**0.000**	**0.004**	–	–	**0.018**	–	–	–
KC-46A - FTU										
55%	–	–	0.000	0.004	–	0.001	–	–	0.000	0.000
60%	–	–	0.000	0.001	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	0.001	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.000**	**0.006**	–	**0.001**	–	–	**0.000**	**0.000**

Scenario/ Engine Setting	Annual Emissions - Tons									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Existing KC-135										
55%	–	–	–	–	0.001	0.001	0.000	0.001	0.000	–
60%	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–
Take-off	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–
Subtotal Existing KC-135	–	–	–	–	**0.001**	**0.002**	**0.000**	**0.001**	**0.000**	–
KC-46A - FTU										
55%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
60%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.000**	–	–	**0.000**	–	–	**0.000**	**0.000**

Key: – = No activity, % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-48. KC-135/KC-46A Aircraft Operations at Lubbock Preston Smith International Airport – Altus AFB KC-46A FTU Scenario

Scenario/ Operation	Operations /Year	Engine Setting/Time in Mode per Operation				Engine Setting Annual Hours			
		55%	60%	Climbout	Takeoff	55%	60%	Climbout	Takeoff
Existing KC-135 [a]									
Closed Pattern - IFR	505	12.0	2.0	–	1.0	101	17	–	8
Closed Pattern - VFR	207	5.0	2.0	–	1.0	17	7	–	3
Total TIMs - Existing KC-135						**118**	**24**	–	**12**
KC-46A - FTU [a]									
Closed Pattern - Radar & Initial to Overhead	316	12.0	2.0	–	1.0	63	11	–	5
Closed Pattern - VFR	129	5.0	2.0	–	1.0	11	4	–	2
Total TIMs - KC-46A FTU						**74**	**15**	–	**7**

[a] Assumes same number of ops as AFW, per SAIC 2013a.

Key: – = No activity, % = percent, AFW = Fort Worth Alliance Airport, FTU = Formal Training Unit, IFR = instrument flight rules, ops = operations, ops = operations, TIM = Time in Mode, VFR = visual flight rules.

Table D.1-49. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Lubbock Preston Smith International Airport – Altus AFB KC-46A FTU Scenario

Scenario/ Engine Setting	Annual Emissions - Tons										
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*	*CO_2e (mt)*
Existing KC-135											
55%	0.08	2.37	11.93	1.08	0.06	0.06	3,266	0.09	0.10	3,299	–
60%	0.02	0.43	2.75	0.23	0.01	0.01	711	0.02	0.02	718	–
Take-off	0.01	0.02	3.43	0.20	0.01	0.01	595	0.02	0.02	602	–
Subtotal Existing KC-135	**0.10**	**2.82**	**18.11**	**1.51**	**0.08**	**0.08**	**4,572**	**0.13**	**0.14**	**4,619**	**–**
KC-46A - FTU											
55%	0.07	1.02	14.70	0.84	0.05	0.04	2,563	0.07	0.08	2,589	–
60%	0.02	0.20	3.45	0.19	0.01	0.01	563	0.02	0.02	568	–
Take-off	0.01	0.10	5.51	0.17	0.01	0.01	516	0.01	0.02	521	–
Subtotal KC-46A FTU	**0.10**	**1.32**	**23.66**	**1.20**	**0.07**	**0.06**	**3,641**	**0.10**	**0.11**	**3,678**	**3,344**

Scenario/ Engine Setting	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Existing KC-135										
55%	–	–	0.002	–	–	0.000	0.002	0.001	–	–
60%	–	–	0.000	–	–	0.000	0.000	0.000	–	–
Take-off	–	–	0.000	–	–	–	0.000	0.000	–	–
Subtotal Existing KC-135	–	–	**0.003**	–	–	**0.001**	**0.002**	**0.001**	–	–
KC-46A - FTU										
55%	0.003	0.002	0.001	0.001	–	–	–	–	–	–
60%	0.001	0.000	0.000	0.000	–	–	–	–	–	–
Take-off	0.001	0.000	0.000	0.000	–	–	–	–	–	–
Subtotal KC-46A FTU	**0.005**	**0.003**	**0.002**	**0.002**	–	–	–	–	–	–

Scenario/ Engine Setting	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Existing KC-135										
55%	–	0.003	0.000	0.011	–	–	0.048	–	–	–
60%	–	0.001	0.000	0.002	–	–	0.011	–	–	–
Take-off	–	0.000	-	0.001	–	–	0.000	–	–	–
Subtotal Existing KC-135	–	**0.004**	**0.000**	**0.014**	–	–	**0.059**	–	–	–
KC-46A - FTU										
55%	–	–	0.000	0.009	–	0.001	–	–	0.000	0.001
60%	–	–	0.000	0.002	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	0.002	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.000**	**0.013**	–	**0.002**	–	–	**0.001**	**0.001**

Scenario/ Engine Setting	Annual Emissions - Tons									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Existing KC-135										
55%	–	–	–	–	0.002	0.004	0.000	0.003	0.001	–
60%	–	–	–	–	0.000	0.001	0.000	0.001	0.000	–
Take-off	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–
Subtotal Existing KC-135	–	–	–	–	**0.003**	**0.005**	**0.001**	**0.004**	**0.001**	–
KC-46A - FTU										
55%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
60%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.000**	–	–	**0.001**	–	–	**0.000**	**0.000**

Key: – = Source does not emit particular pollutant, % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-50. KC-135/KC-46A Aircraft Operations at Fort Worth Alliance Airport – Altus AFB KC-46A FTU Scenario

Scenario/Operation	Operations Per Year	Engine Setting/Time in Mode per Operation				Engine Setting Annual Hours			
		55%	*60%*	*Climbout*	*Takeoff*	*55%*	*60%*	*Climbout*	*Takeoff*
Existing KC-135 [a]									
Closed Pattern - IFR	505	12.0	2.0	–	1.0	101	17	–	8
Closed Pattern - VFR	207	5.0	2.0	–	1.0	17	7	–	3
Total TIMs - Existing KC-135						**118**	**24**	–	**12**
KC-46A - FTU [b]									
Closed Pattern - Radar & Initial to Overhead	316	12.0	2.0	–	1.0	63	11	–	5
Closed Pattern - VFR	129	5.0	2.0	–	1.0	11	4	–	2
Total TIMs - KC-46A FTU						**74**	**15**	–	**7**

[a] SAIC 2013e.

[b] Assumes 37.5% fewer KC-46A ops, per SAIC 2013a.

Key: – = No activity, % = percent, FTU = Formal Training Unit, IFR = instrument flight rules, ops = operations, TIM = Time in Mode, VFR = visual flight rules.

Table D.1-51. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Fort Worth Alliance Airport – Altus AFB KC-46A FTU Scenario

Scenario/ Engine Setting	Annual Emissions - Tons										
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*	*CO_2e (mt)*
Existing KC-135											
55%	0.08	2.37	11.93	1.08	0.06	0.06	3,266	0.09	0.10	3,299	–
60%	0.02	0.43	2.75	0.23	0.01	0.01	711	0.02	0.02	718	–
Take-off	0.01	0.02	3.43	0.20	0.01	0.01	595	0.02	0.02	602	–
Subtotal Existing KC-135	**0.10**	**2.82**	**18.11**	**1.51**	**0.08**	**0.08**	**4,572**	**0.13**	**0.14**	**4,619**	**–**
KC-46A - FTU											
55%	0.07	1.02	14.70	0.84	0.05	0.04	2,563	0.07	0.08	2,589	–
60%	0.02	0.20	3.45	0.19	0.01	0.01	563	0.02	0.02	568	–
Take-off	0.01	0.10	5.51	0.17	0.01	0.01	516	0.01	0.02	521	–
Subtotal KC-46A FTU	**0.10**	**1.32**	**23.66**	**1.20**	**0.07**	**0.06**	**3,641**	**0.10**	**0.11**	**3,678**	**3,344**

Scenario/ Engine Setting	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Existing KC-135										
55%	–	–	0.002	–	–	0.000	0.002	0.001	–	–
60%	–	–	0.000	–	–	0.000	0.000	0.000	–	–
Take-off	–	–	0.000	–	–	–	0.000	0.000	–	–
Subtotal Existing KC-135	–	–	**0.003**	–	–	**0.001**	**0.002**	**0.001**	–	–
KC-46A - FTU										
55%	0.003	0.002	0.001	0.001	–	–	–	–	–	–
60%	0.001	0.000	0.000	0.000	–	–	–	–	–	–
Take-off	0.001	0.000	0.000	0.000	–	–	–	–	–	–
Subtotal KC-46A FTU	**0.005**	**0.003**	**0.002**	**0.002**	–	–	–	–	–	–

Scenario/ Engine Setting	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Existing KC-135										
55%	–	0.003	0.000	0.011	–	–	0.048	–	–	–
60%	–	0.001	0.000	0.002	–	–	0.011	–	–	–
Take-off	–	0.000	-	0.001	–	–	0.000	–	–	–
Subtotal Existing KC-135	–	**0.004**	**0.000**	**0.014**	–	–	**0.059**	–	–	–
KC-46A - FTU										
55%	–	–	0.000	0.009	–	0.001	–	–	0.000	0.001
60%	–	–	0.000	0.002	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	0.002	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.000**	**0.013**	**-**	**0.002**	–	–	**0.001**	**0.001**

Scenario/ Engine Setting	Annual Emissions - Tons									
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Existing KC-135										
55%	–	–	–	–	0.002	0.004	0.000	0.003	0.001	–
60%	–	–	–	–	0.000	0.001	0.000	0.001	0.000	–
Take-off	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–
Subtotal Existing KC-135	–	–	–	–	**0.003**	**0.005**	**0.001**	**0.004**	**0.001**	–
KC-46A - FTU										
55%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
60%	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	–	–	**0.000**	–	–	**0.001**	–	–	**0.000**	**0.000**

Key: – = Source does not emit particular pollutant, % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.1-52. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Altus AFB – Year 2016

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
KC-46A Aircraft Operations	50.07	201.73	837.56	45.42	2.92	2.49	136,813	3.79	4.25	125,647
On-Wing Aircraft Engine Testing - KC-46A	14.39	49.54	28.94	2.34	0.21	0.19	6,844	0.19	0.21	6,286
Aerospace Ground Support Equipment - KC-46A	0.21	1.51	1.70	0.07	0.25	0.23	1,848	0.29	0.00	1,686
C-17 Aircraft Operations	25.92	234.56	811.10	68.54	202.86	202.86	125,665	3.48	3.91	104,917
KC-135 Aircraft Operations	3.87	155.10	210.64	35.75	52.00	52.00	65,544	1.81	2.04	54,722
Transient Aircraft	1.38	5.07	3.15	0.31	0.77	0.77	577	0.02	0.02	530
On-Wing Aircraft Engine Testing - C-17	0.16	7.77	9.77	0.64	4.24	4.24	1,956	0.05	0.06	1,633
On-Wing Aircraft Engine Testing - KC-135	0.99	14.32	7.07	0.82	0.05	0.05	2,481	0.07	0.08	2,071
Aerospace Ground Support Equipment - Existing Aircraft	0.59	4.27	4.83	0.19	0.71	0.65	5,181	0.80	0.06	4,741
Government Motor Vehicles	0.10	1.01	2.19	0.01	0.12	0.10	723	0.00	0.00	657
Privately-Owned Vehicles - On-Base	0.16	8.90	1.12	0.03	0.10	0.05	1,684	0.00	0.00	1,531
Privately-Owned Vehicles - Off-Base	0.49	26.35	2.94	0.07	0.42	0.18	4,802	0.01	0.00	4,366
Nonroad Equipment	6.89	96.45	2.94	0.63	0.37	0.37	3,400	8.10	0.02	3,250
Mobile Fuel Transfer Operations	0.14	–	–	–	–	–	–	–	–	–
Point and Area Sources	2.84	8.73	14.38	0.26	1.56	0.70	–	–	–	–
Total Proposed Emissions - 2016	**108.19**	**815.32**	**1,938.34**	**155.06**	**266.59**	**264.88**	**357,518**	**18.61**	**10.65**	**312,037**
Year 2012 Base Case Emissions	**(55.39)**	**(573.25)**	**(1,069.38)**	**(106.96)**	**(262.74)**	**(261.86)**	**(208,787)**	**(11.67)**	**(6.17)**	**(191,769)**
Proposed Year 2016 minus Base Case Emissions	**52.80**	**242.07**	**868.96**	**48.10**	**3.85**	**3.01**	**148,731**	**6.93**	**4.47**	**120,269**
Jackson County PSD Thresholds	**250**	**250**	**250**	**250**	**250**	**250**				
Proposed Fractional Increase from Altus 2012 Emissions	**0.95**	**0.42**	**0.81**	**0.45**	**0.01**	**0.01**	**0.71**	**0.59**	**0.72**	**0.63**

Source Type	Tons per Year									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Cumene*	*Dibutyl Phthalate*
KC-46A Aircraft Operations	2.157	1.237	0.849	0.852	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-46A	0.620	0.356	0.244	0.245	-	-	-	-		-
Aerospace Ground Support Equipment - KC-46A	0.001	0.000	0.002	0.000	–	–	–	–	–	–
C-17 Aircraft Operations	0.094	–	0.199	–	0.007	–	0.036	0.005	–	–
KC-135 Aircraft Operations	–	–	0.050	–	–	0.006	0.078	0.032	–	–
Transient Aircraft	0.003	0.004	0.006	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.004	–	0.008	–	0.000	–	0.001	0.000	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	0.001	–	–	0.000	0.001	0.001	–	–
Aerospace Ground Support Equipment - Existing Aircraft	0.001	0.000	0.006	0.001	–	–	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Nonroad Equipment	0.010	0.002	0.027	0.001	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.001	–	–	–	–	–	0.000	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**2.891**	**1.598**	**1.394**	**1.099**	**0.007**	**0.006**	**0.116**	**0.037**	**0.000**	**-**
Year 2012 Base Case Emissions	**(0.114)**	**(0.006)**	**(0.307)**	**(0.002)**	**(0.007)**	**(0.006)**	**(0.116)**	**(0.037)**	**(0.000)**	**(0.020)**
Proposed Year 2016 minus Base Case Emissions	**2.777**	**1.592**	**1.087**	**1.097**	**-**	**-**	**-**	**-**	**0.000**	**(0.020)**
Jackson County PSD Thresholds										
Proposed Fractional Increase from Altus 2012 Emissions	**24.37**	**279.90**	**3.54**	**523.57**	**-**	**-**	**-**	**-**	**0.49**	**(1.00)**

Table D.1-52. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Altus AFB – Year 2016 (Continued)

Source Type	Tons per Year										
	1,2-Dichloro-propane	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methyl-ene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
KC-46A Aircraft Operations	–	–	–	0.088	6.216	–	0.912	–	–	0.273	0.367
On-Wing Aircraft Engine Testing - KC-46A	-	-	-	0.025	1.787	-	0.262	-	-	0.079	0.105
Aerospace Ground Support Equipment - KC-46A	–	–	–	0.001	0.001	0.000	–	–	0.005	0.000	–
C-17 Aircraft Operations	0.020	0.049	0.197	0.080	0.022	2.237	–	–	0.127	–	0.019
KC-135 Aircraft Operations	–	–	–	0.186	0.014	2.040	–	–	2.100	–	0.059
Transient Aircraft	–	–	–	–	0.001	0.021	–	–	–	–	0.002
On-Wing Aircraft Engine Testing - C-17	–	0.000	0.001	0.003	0.001	0.001	0.083	–	–	0.002	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	0.003	0.000	0.046	–	–	0.036	–
Aerospace Ground Support Equipment - Existing Aircraft	–	–	–	–	0.002	0.003	0.001	–	–	0.014	0.000
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–	–
Nonroad Equipment	–	–	–	0.010	0.021	0.005	–	–	0.076	–	–
Mobile Fuel Transfer Operations	–	–	–	0.000	–	0.000	–	–	0.001	0.000	–
Point and Area Sources	–	–	–	–	–	0.167	–	–	–	–	–
Total Proposed Emissions - 2016	**0.020**	**0.050**	**0.198**	**0.393**	**8.068**	**4.474**	**1.303**	**-**	**2.308**	**0.404**	**0.551**
Year 2012 Base Case Emissions	**(0.050)**	**(0.200)**	**(0.271)**	**(0.053)**	**(4.454)**	**(0.119)**	**-**	**(2.265)**	**(0.114)**	**(0.081)**	**(0.031)**
Proposed Year 2016 minus Base Case Emissions	**(0.030)**	**(0.150)**	**(0.073)**	**0.341**	**3.614**	**4.355**	**1.303**	**(2.265)**	**2.194**	**0.323**	**0.520**
Jackson County PSD Thresholds											
Proposed Fractional Increase from Altus 2012 Emissions	**(0.60)**	**(0.75)**	**(0.27)**	**6.48**	**0.81**	**36.60**	**#DIV/0!**	**(1.00)**	**19.16**	**3.96**	**16.81**

Source Type	Tons per Year										
	POM	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-46A Aircraft Operations	–	–	0.156	–	–	0.324	–	–	–	0.143	0.084
On-Wing Aircraft Engine Testing - KC-46A	-	-	0.045	-	-	0.093	-		-	0.041	0.024
Aerospace Ground Support Equipment - KC-46A	0.000	0.000	0.000	–	–	0.003	–	–	–	–	0.002
C-17 Aircraft Operations	0.030	–	–	0.012	0.069	–	0.092	–	0.005	–	–
KC-135 Aircraft Operations	–	–	–	0.030	–	0.050	0.207	–	0.017	–	0.147
Transient Aircraft	–	–	–	0.001	–	–	0.003	–	–	–	–
On-Wing Aircraft Engine Testing - C-17	0.001	0.001	–	–	0.001	0.001	–	–	0.003	–	0.000
On-Wing Aircraft Engine Testing - KC-135	0.001	–	–	–	0.001	–	0.001	–	0.005	–	0.000
Aerospace Ground Support Equipment - Existing Aircraft	–	0.000	0.000	0.000	–	–	0.007	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base		–	–	–	–	–	–	–	–	–	–
Nonroad Equipment	0.000	0.195	0.000	–	–	0.035	–	–	–	–	0.033
Mobile Fuel Transfer Operations	–	–	–	–	–	0.002	–	0.000	–	–	0.002
Point and Area Sources	–	–	–	–	–	0.011	–	–	–	–	0.011
Total Proposed Emissions - 2016	**0.032**	**0.196**	**0.202**	**0.043**	**0.070**	**0.520**	**0.310**	**0.000**	**0.029**	**0.183**	**0.304**
Year 2012 Base Case Emissions	**(0.000)**	**(0.241)**	**(0.045)**	**(0.070)**	**(0.051)**	**(0.372)**	**(0.022)**	**(0.000)**	**(0.150)**	**(0.081)**	**(0.070)**
Proposed Year 2016 minus Base Case Emissions	**0.032**	**(0.045)**	**0.157**	**(0.027)**	**0.018**	**0.148**	**0.288**	**0.000**	**(0.121)**	**0.103**	**0.235**
Jackson County PSD Thresholds											
Proposed Fractional Increase from Altus 2012 Emissions	**89.80**	**(0.19)**	**3.51**	**(0.38)**	**0.36**	**0.40**	**12.94**	**0.49**	**(0.81)**	**1.27**	**3.37**

Key: ( ) = parenthesis indicate negative numbers, – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, N_2O = nitrous oxide, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, VOC = volatile organic compound.

D.2 FAIRCHILD AIR FORCE BASE REGIONAL CLIMATE

Fairchild AFB has a semi-arid continental climate, characterized by pronounced variations in daily and seasonal temperatures and seasonal and annual precipitation. Meteorological data collected at Spokane International Airport and Fairchild AFB are used to describe the climate of the Fairchild AFB project region (WRCC 2013a, 2013b, 2013c).

Temperature. Temperatures at Fairchild AFB are relatively warm in the summer months and cold during the winter. The average high and low temperatures during the summer months at Spokane International Airport range from about 84 °F to 50 °F. The average high and low temperatures during the winter months range from 48 °F to 22 °F (WRCC 2013a).

Precipitation. Average annual precipitation at Fairchild AFB is 16.1 inches. Precipitation is greatest during the colder months of the year, and the peak monthly average of 2.2 inches occurs in December. Precipitation is at a minimum during the summer, as the lowest monthly average of 0.5 inches occurs in July. Snow is common during the coldest months of the year; the average annual snowfall is 42.0 inches (WRCC 2013a).

Prevailing Winds. Fairchild AFB experiences fairly breezy conditions, as the average wind speed for each month of the year is at least 8.3 miles per hour and the annual average wind speed is 9.4 miles per hour (WRCC 2013b). The colder months of the year have the windiest conditions, and the peak average monthly winds of 10.7 miles per hour occur in March. The wind prevails from the south-southwest direction for 11 months of the year at Fairchild AFB (WRCC 2013c).

D.2.1 OPERATIONS EMISSION CALCULATIONS FOR THE KC-46A PROJECT SCENARIOS AT FAIRCHILD AFB

Table D.2-1. Annual Air Operations for Aircraft at Altus AFB – Year 2008

Aircraft	Number of Operations				
	LTO	*TGO*	*LFB*	*LFP*	*Total*
C-17	17,052	35,092	0	35,092	87,236
KC-135	6,702	44,520	0	44,520	95,742
Transient	195	–	–	–	195

Key: – = No activity, LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: 2008 AEI (Weston Solutions, Inc. 2008).

Table D.2-2. Annual Air Operations for Aircraft at Fairchild AFB – Year 2012

Aircraft	Number of Operations				
	LTO	*TGO*	*LFB*	*LFP*	*Total*
KC-135	1,474	–	–	5,983	**7,457**
UH-60	1,302	–	–	720	**2,022**
UH-1N	412	–	–	2,184	**2,596**
Transient	975	–	–	2,205	**3,179**
Totals	**4,162**	–	–	**11,091**	**15,253**

Key: – = No activity, LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: Table 2-11.

Table D.2-3. Year 2012 Aircraft Closed Pattern Operations at Fairchild AFB – KC-46A Project Existing Conditions

Aircraft Type/Operation	Operations/ Year	Engine Setting/Time in Mode (Minutes)				Engine Setting Annual Hours			
		55%	*60%*	*Climbout*	*Takeoff*	*55%*	*60%*	*Climbout*	*Takeoff*
KC-135									
Closed Pattern - Radar & Initial to Overhead	2,782	12.0	2.0	–	1.0	556	93	–	46
Closed Pattern - VFR	1,890	5.0	2.0	–	1.0	157	63	–	31
Closed Pattern - Tactical	1,311	8.0	2.0	2.0	1.0	175	44	44	22
Total TIMs -						**889**	**199**	**44**	**100**
Transient[a]									
Closed Pattern - Radar & Initial to Overhead	1,025	12.0	2.0	–	1.0	205	34	–	17
Closed Pattern - VFR	696	5.0	2.0	–	1.0	58	23	–	12
Closed Pattern - Tactical	483	8.0	2.0	2.0	1.0	64	16	16	8
Total TIMs -						**327**	**73**	**16**	**37**

[a] Engine setting TIMs assumed = KC-135 as they are large aircraft = C-17s and P-3Cs.
Key: – = No activity, % = percent, TIM = Time in Mode, VFR = visual flight rules.

Table D.2-4. Emission Factors and Fuel Usages for Existing Aircraft Operations at Fairchild AFB

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
LTO											
KC-135	5,134	6.92	102.65	37.70	5.44	0.30	0.30	16,510	0.46	0.51	16,678
UH-60[a]	661	1.40	12.30	3.40	0.30	2.30	2.30	3,000	0.08	0.09	3,031
UH-1N[b]	280	0.67	3.32	1.28	0.11	1.18	1.18	893	0.02	0.03	902
Closed Pattern											
KC-135 - Tactical	5,789	0.32	1.20	94.59	6.14	0.32	0.32	18,617	0.52	0.58	18,807
UH-60[c]	343	0.19	1.89	2.27	0.14	1.44	1.44	1,106	0.03	0.03	1,117
UH-1N[d]	106	0.02	0.36	0.52	0.04	0.45	0.45	340	0.01	0.01	343

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		Acetalde-hyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloroform	Chloro-methane	o-Cresol	p-Cresol
LTO											
KC-135	5,134	–	–	0.010	–	–	0.001	0.011	0.004	–	–
UH-60[a]	661	0.005	0.002	0.013	–	0.000	0.000	0.000	–	0.000	0.032
UH-1N[b]	280	0.002	0.001	0.006	–	0.000	0.000	0.000	–	0.000	0.014
Closed Pattern											
KC-135 - Tactical	5,789	–	–	0.004	–	–	0.002	0.009	0.004	–	–
UH-60[c]	343	0.003	0.001	0.007	–	0.000	0.000	0.000	–	0.000	0.017
UH-1N[d]	106	0.001	0.000	0.002	–	0.000	0.000	0.000	–	0.000	0.005

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		Dibenzo-furan	Dibutyl Phthalate	1,2-Dichloro-propane	2,4-Dinitro-phenol	Di(2-Ethylhexyl) Phthalate (DEHP)	Ethyl-benzene	Formalde-hyde	Hexane	Methanol	Methylene Chloride
LTO											
KC-135	5,134	–	–	–	–	0.023	0.003	0.326	–	–	0.291
UH-60[a]	661	0.000	0.000	–	–	0.001	0.001	0.060	–	–	0.005
UH-1N[b]	280	0.000	0.000	–	–	0.000	0.000	0.025	–	–	0.002
Closed Pattern											
KC-135 - Tactical	5,789	–	–	–	–	0.022	0.000	0.036	–	–	0.229
UH-60[c]	343	0.000	0.000	–	–	0.000	0.000	0.031	–	–	0.003
UH-1N[d]	106	0.000	0.000	–	–	0.000	0.000	0.010	–	–	0.001

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		MIBK	MTBE	Naphth-alene	Phenol	POM	Propionald-ehyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetrachlor-oethene	Toluene
LTO											
KC-135	5,134	–	–	0.009	–	–	-	0.005	–	0.010	0.036
UH-60[a]	661	0.000	–	0.002	0.002	–	-	0.001	0.000	–	0.004
UH-1N[b]	280	0.000	–	0.001	0.001	–	-	0.001	0.000	–	0.002
Closed Pattern											
KC-135 - Tactical	5,789	–	–	–	–	–	–	–	–	0.004	0.009
UH-60[c]	343	0.000	–	0.001	0.001	–	–	0.001	0.000	–	0.002
UH-1N[d]	106	0.000	–	0.000	0.000	–	–	0.000	0.000	–	0.001

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)				
		1,1,1-Trichloro-ethane	Trichloro-ethene	Vinyl Acetate	mp-Xylene	o-Xylene
LTO						
KC-135	5,134	0.003	–	0.022	0.007	–
UH-60[a]	661	0.000	0.000	–	0.001	0.001
UH-1N[b]	280	0.000	0.000	–	0.001	0.000
Closed Pattern						
KC-135 - Tactical	5,789	0.001	–	0.015	0.003	–
UH-60[c]	343	0.000	0.000	–	0.001	0.000
UH-1N[d]	106	0.000	0.000	–	0.000	0.000

[a] Aircraft Emission Estimates: H-60 Landing and Takeoff Cycle and In-Frame, Maintenance Testing Using JP-5 (Aircraft Environmental Support Office – Fleet Readiness Center Southwest [AESO] 2009a).

[b] Aircraft Emission Estimates: HH/UH-1N Landing and Takeoff Cycle and Maintenance Testing Using JP-5 (AESO 2009b).

[c] GCA Box Pattern – Source: Aircraft Emission Estimates: H-60 Mission Operations Using JP-5 (AESO 2011).

[d] GCA Box Pattern – Source: Aircraft Emission Estimates: UH-1 and HH-1 Mission Operations Using JP-5 (AESO 2009c).

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, LTO = landing and takeoff, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-5. Annual Air Emissions from Year 2012 Aircraft Operations at Fairchild AFB Scenarios – KC-46A Project Scenario Existing Conditions

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Altus AFB - Year 2008										
Transient Aircraft Operations	0.79	2.90	1.80	0.18	0.44	0.44	330	0.01	0.01	333
Year 2012 - LTOs										
KC-135 Aircraft Operations	5.10	75.65	27.79	4.01	0.22	0.22	12,168	0.34	0.38	12,292
UH-60	0.91	8.00	2.21	0.20	1.50	1.50	1,952	0.05	0.06	1,972
UH-1N	0.14	0.68	0.26	0.02	0.24	0.24	184	0.01	0.01	186
Transient Aircraft Operations	3.95	14.49	9.00	0.90	2.20	2.20	1,649	0.05	0.05	1,666
Subtotal - Year 2012 LTOs	**10.10**	**98.83**	**39.26**	**5.13**	**4.16**	**4.16**	**15,953**	**0.44**	**0.50**	**16,116**
Closed Patterns										
KC-135 - 55%	0.58	17.79	89.59	8.09	0.42	0.42	24,532	0.68	0.76	24,782
KC-135 - 60%	0.14	3.64	23.14	1.97	0.10	0.10	5,974	0.17	0.19	6,035
KC-135 - Climbout	0.03	0.05	9.07	0.60	0.03	0.03	1,823	0.05	0.06	1,842
KC-135 - Take-off	0.07	0.14	28.78	1.65	0.11	0.11	5,003	0.14	0.16	5,054
UH-60	0.07	0.68	0.82	0.05	0.52	0.52	398	0.01	0.01	402
UH-1N	0.02	0.39	0.57	0.04	0.49	0.49	371	0.01	0.01	375
Transient Aircraft Operations	0.30	7.97	55.49	4.53	0.24	0.24	13,757	0.38	0.43	13,897
Subtotal - Year 2012 Closed Patterns	**1.22**	**30.65**	**207.45**	**16.93**	**1.92**	**1.92**	**51,858**	**1.44**	**1.61**	**52,388**
Total Year 2012	**11.31**	**129.49**	**246.71**	**22.06**	**6.08**	**6.08**	**67,811**	**1.88**	**2.11**	**68,504**
Total KC-135 Aircraft Operations	**5.92**	**97.27**	**178.37**	**16.32**	**0.89**	**0.89**	**49,500**	**1.37**	**1.54**	**50,006**
Total UH-60	**0.98**	**8.68**	**3.03**	**0.25**	**2.02**	**2.02**	**2,350**	**0.07**	**0.07**	**2,374**
Total UH-1N	**0.16**	**1.08**	**0.83**	**0.07**	**0.73**	**0.73**	**555**	**0.02**	**0.02**	**561**
Total Transient Aircraft Operations	**4.25**	**22.46**	**64.48**	**5.43**	**2.44**	**2.44**	**15,406**	**0.43**	**0.48**	**15,563**

Scenario/Source	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Altus AFB - Year 2008										
Transient Aircraft Operations	0.002	0.002	0.003	–	–	–	–	–	–	–
Year 2012 - LTOs										
KC-135 Aircraft Operations	–	–	0.007	–	–	0.001	0.008	0.003	–	–
UH-60	0.003	0.001	0.008	–	0.000	0.000	0.000	–	0.000	0.021
UH-1N	0.000	0.000	0.001	–	0.000	0.000	0.000	–	0.000	0.003
Transient Aircraft Operations	0.01	0.01	0.02	–	–	–	–	–	–	–
Subtotal - Year 2012 LTOs	**0.013**	**0.012**	**0.034**	–	**0.000**	**0.001**	**0.008**	**0.003**	**0.000**	**0.024**
Closed Patterns										
KC-135 - 55%	–	–	0.015	–	–	0.004	0.014	0.006	–	–
KC-135 - 60%	–	–	0.003	–	–	0.001	0.003	0.002	–	–
KC-135 - Climbout	–	–	0.000	–	–	0.000	0.001	0.000	–	–
KC-135 - Take-off	–	–	0.002	–	–	–	0.002	0.001	–	–
UH-60	0.001	0.000	0.002	–	0.000	0.000	0.000	–	0.000	0.006
UH-1N	0.001	0.000	0.002	–	0.000	0.000	0.000	–	0.000	0.006
Transient Aircraft Operations	0.001	0.001	0.001	–	–	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	**0.002**	**0.002**	**0.026**	–	**0.000**	**0.005**	**0.020**	**0.009**	**0.000**	**0.012**
Total Year 2012	**0.015**	**0.014**	**0.060**	–	**0.000**	**0.005**	**0.028**	**0.012**	**0.000**	**0.035**
Total KC-135 Aircraft Operations	–	–	**0.027**	–	–	**0.005**	**0.028**	**0.012**	–	–
Total UH-60	**0.004**	**0.002**	**0.011**	–	**0.000**	**0.000**	**0.000**	–	**0.000**	**0.027**
Total UH-1N	**0.001**	**0.001**	**0.003**	–	**0.000**	**0.000**	**0.000**	–	**0.000**	**0.008**
Total Transient Aircraft Operations	**0.010**	**0.012**	**0.018**	–	–	–	–	–	–	–

Table D.2-5. Annual Air Emissions from Year 2012 Aircraft Operations at Fairchild AFB Scenarios – KC-46A Project Scenario Existing Conditions (Continued)

Scenario/Source	Annual Emissions - Tons									
	Dibenzo-furan	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*Di(2-Ethylhexyl) Phthalate (DEHP)*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*
Altus AFB - Year 2008										
Transient Aircraft Operations	–	–	–	–	–	0.000	0.012	–	–	–
Year 2012 - LTOs										
KC-135 Aircraft Operations	–	–	–	–	0.017	0.002	0.240	–	–	0.215
UH-60	0.000	0.000	–	–	0.000	0.000	0.039	–	–	0.003
UH-1N	0.000	0.000	–	–	0.000	0.000	0.005	–	–	0.000
Transient Aircraft Operations	–	–	–	–	-	0.00	0.06	–	–	–
Subtotal - Year 2012 LTOs	**0.000**	**0.000**	**–**	**–**	**0.017**	**0.004**	**0.344**	**–**	**–**	**0.218**
Closed Patterns										
KC-135 - 55%	–	–	–	–	0.022	0.002	0.082	–	–	0.361
KC-135 - 60%	–	–	–	–	0.006	0.000	0.018	–	–	0.089
KC-135 - Climbout	–	–	–	–	0.003	–	0.003	–	–	0.029
KC-135 - Take-off	–	–	–	–	0.003	–	0.011	–	–	0.003
UH-60	0.000	0.000	–	–	0.000	0.000	0.011	–	–	0.001
UH-1N	0.000	0.000	–	–	0.000	0.000	0.010	–	–	0.001
Transient Aircraft Operations	–	–	–	–	–	0.000	0.005	–	–	–
Subtotal - Year 2012 Closed Patterns	**0.000**	**0.000**	**–**	**–**	**0.034**	**0.003**	**0.140**	**–**	**–**	**0.483**
Total Year 2012	**0.000**	**0.000**	**–**	**–**	**0.051**	**0.007**	**0.484**	**–**	**–**	**0.702**
Total KC-135 Aircraft Operations	**–**	**–**	**–**	**–**	**0.050**	**0.005**	**0.354**	**–**	**–**	**0.696**
Total UH-60	**0.000**	**0.000**	**–**	**–**	**0.000**	**0.001**	**0.050**	**–**	**–**	**0.004**
Total UH-1N	**0.000**	**0.000**	**–**	**–**	**0.000**	**0.000**	**0.016**	**–**	**–**	**0.001**
Total Transient Aircraft Operations	**–**	**–**	**–**	**–**	**–**	**0.002**	**0.065**	**–**	**–**	**–**

Scenario/Source	Annual Emissions - Tons									
	MIBK	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propionald-ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetrachlor-oethene*	*Toluene*
Altus AFB - Year 2008										
Transient Aircraft Operations	–	–	0.001	–	–	–	0.001	–	–	0.002
Year 2012 - LTOs										
KC-135 Aircraft Operations	–	–	0.007	–	–	–	0.004	–	0.007	0.026
UH-60	0.000	–	0.001	0.001	–	–	0.001	0.000	–	0.002
UH-1N	0.000	–	0.000	0.000	–	–	0.000	0.000	–	0.000
Transient Aircraft Operations	–	–	0.01	–	–	–	0.00	–	–	0.01
Subtotal - Year 2012 LTOs	**0.000**	**–**	**0.013**	**0.001**	**–**	**–**	**0.007**	**0.000**	**0.007**	**0.037**
Closed Patterns										
KC-135 - 55%	–	–	–	–	–	–	–	–	0.015	0.031
KC-135 - 60%	–	–	–	–	–	–	–	–	0.003	0.007
KC-135 - Climbout	–	–	–	–	–	–	–	–	0.000	0.001
KC-135 - Take-off	–	–	–	–	–	–	–	–	0.002	0.002
UH-60	0.000	–	0.000	0.000	–	–	0.000	0.000	–	0.001
UH-1N	0.000	–	0.000	0.000	–	–	0.000	0.000	–	0.001
Transient Aircraft Operations	–	–	0.000	–	–	–	0.000	–	–	0.001
Subtotal - Year 2012 Closed Patterns	**0.000**	**–**	**0.001**	**0.001**	**–**	**–**	**0.001**	**0.000**	**0.020**	**0.042**
Total Year 2012	**0.000**	**–**	**0.014**	**0.002**	**–**	**–**	**0.008**	**0.000**	**0.027**	**0.079**
Total KC-135 Aircraft Operations	**–**	**–**	**0.007**	**–**	**–**	**–**	**0.004**	**–**	**0.027**	**0.066**
Total UH-60	**0.000**	**–**	**0.002**	**0.001**	**–**	**–**	**0.001**	**0.000**	**–**	**0.003**
Total UH-1N	**0.000**	**–**	**0.001**	**0.000**	**–**	**–**	**0.000**	**0.000**	**–**	**0.001**
Total Transient Aircraft Operations	**–**	**–**	**0.005**	**–**	**–**	**–**	**0.003**	**–**	**–**	**0.009**

Table D.2-5. Annual Air Emissions from Year 2012 Aircraft Operations at Fairchild AFB Scenarios – KC-46A Project Scenario Existing Conditions (Continued)

Scenario/Source	Annual Emissions - Tons				
	1,1,1-Trichloro-ethane	*Trichloro-ethene*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Altus AFB - Year 2008					
Transient Aircraft Operations	–	–	–	–	–
Year 2012 - LTOs					
KC-135 Aircraft Operations	0.002	–	0.016	0.005	–
UH-60	0.000	0.000	–	0.001	0.001
UH-1N	0.000	0.000	–	0.000	0.000
Transient Aircraft Operations	–	–	–	–	–
Subtotal - Year 2012 LTOs	**0.003**	**0.000**	**0.016**	**0.006**	**0.001**
Closed Patterns					
KC-135 - 55%	0.003	–	0.025	0.009	–
KC-135 - 60%	0.001	–	0.006	0.002	–
KC-135 - Climbout	–	–	0.001	0.000	–
KC-135 - Take-off	0.000	–	0.004	0.001	–
UH-60	0.000	0.000	–	0.000	0.000
UH-1N	0.000	0.000	–	0.000	0.000
Transient Aircraft Operations	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	**0.005**	**0.000**	**0.036**	**0.012**	**0.000**
Total Year 2012	**0.007**	**0.000**	**0.052**	**0.018**	**0.001**
Total KC-135 Aircraft Operations	**0.007**	**–**	**0.052**	**0.017**	**–**
Total UH-60	**0.000**	**0.000**	**–**	**0.001**	**0.001**
Total UH-1N	**0.000**	**0.000**	**–**	**0.000**	**0.000**
Total Transient Aircraft Operations	**–**	**–**	**–**	**–**	**–**

Key: – = Source does not emit particular pollutant, % = percent, AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, LTO = landing and takeoff, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-6. Year 2012 AGE Usages – Fairchild AFB

Source	Hp	Load Factor	Annual Hours	Annual HP-Hrs
Floodlight (FL-1D & NF2D & lightcart)	10.5	0.74	4,320	33,566
MC-2A Air Compressor	10.5	0.48	108	544
Jacking Manifold	24.0	0.51	120	1,469
MC-7 Air Compressor	48.0	0.48	25	576
SGNSC	49.0	0.51	286	7,147
MC20 Air Compressor	50.0	1.00	42	2,100
Subtotal - 10-50 Hp				**45,403**
Generator, A/M32A-60A	80.4	0.95	5	382
Generator Set (Power Unit) - 86/B809	105.9	0.95	18,480	1,858,478
Air Conditioners, MA-3D	120.0	0.28	25	840
A/M32A-95 LASS Air Cart	127.3	0.95	168	20,317
Next Generation Heater (NGH)	154.1	0.95	918	134,391
Subtotal - 100-175 Hp				**2,014,026**
Hyd Test Stand, (KC-135)	195.0	0.51	66	6,564
Hyd Test Stand, Helicopter	195.0	0.51	16	1,591
Subtotal - 176-300 Hp				**8,155**

Key: Hp = horsepower, Hr = hour, NGH = Next Generation Heater, SGNSC = Self-Generating Nitrogen Servicing Cart.
Source: SAIC 2013g.

Table D.2-7. Year 2012 Average Nonroad Equipment Emission Factors – Fairchild AFB

Hp Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
Nonroad Equipment - 25-40 Hp	0.70	3.43	4.87	0.13	0.50	0.46	608.97	0.094	0.007	613
Nonroad Equipment - 41-50 Hp	0.50	2.56	4.93	0.13	0.45	0.41	609.60	0.094	0.007	614
Nonroad Equipment - 51-75 Hp	0.48	2.52	4.90	0.13	0.44	0.40	610.89	0.094	0.007	615
Nonroad Equipment - 76-100 Hp	0.52	3.68	4.61	0.13	0.53	0.49	607.38	0.094	0.007	611
Nonroad Equipment - 101-175 Hp	0.54	3.92	4.58	0.13	0.61	0.56	607.97	0.094	0.007	612
Nonroad Equipment - 176-300 Hp	0.38	1.72	4.09	0.11	0.38	0.35	546.53	0.094	0.007	551

Hp Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butad-iene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Year 2012										
Nonroad Equipment - 25-40 Hp	0.052	0.008	0.014	0.001	–	–	–	–	–	–
Nonroad Equipment - 41-50 Hp	0.037	0.006	0.010	0.001	–	–	–	–	–	–
Nonroad Equipment - 51-75 Hp	0.036	0.006	0.010	0.001	–	–	–	–	–	–
Nonroad Equipment - 76-100 Hp	0.039	0.006	0.011	0.001	–	–	–	–	–	–
Nonroad Equipment - 101-175 Hp	0.040	0.006	0.011	0.001	–	–	–	–	–	–
Nonroad Equipment - 176-300 Hp	0.028	0.004	0.008	0.001	–	–	–	–	–	–

Hp Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methyl-ene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Year 2012										
Nonroad Equipment - 25-40 Hp	–	–	0.002	0.105	0.001	–	–	–	–	–
Nonroad Equipment - 41-50 Hp	–	–	0.002	0.075	0.001	–	–	–	–	–
Nonroad Equipment - 51-75 Hp	–	–	0.001	0.072	0.001	–	–	–	–	–
Nonroad Equipment - 76-100 Hp	–	–	0.002	0.078	0.001	–	–	–	–	–
Nonroad Equipment - 101-175 Hp	–	–	0.002	0.081	0.001	–	–	–	–	–
Nonroad Equipment - 176-300 Hp	–	–	0.001	0.057	0.001	–	–	–	–	–

Hp Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	POM	*Propio-nald-ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2012										
Nonroad Equipment - 25-40 Hp	0.000	0.007	0.000	–	–	0.011	–	–	–	0.007
Nonroad Equipment - 41-50 Hp	0.000	0.005	0.000	–	–	0.008	–	–	–	0.005
Nonroad Equipment - 51-75 Hp	0.000	0.005	0.000	–	–	0.007	–	–	–	0.005
Nonroad Equipment - 76-100 Hp	0.000	0.005	0.000	–	–	0.008	–	–	–	0.006
Nonroad Equipment - 101-175 Hp	0.000	0.005	0.000	–	–	0.008	–	–	–	0.006
Nonroad Equipment - 176-300 Hp	0.000	0.004	0.000	–	–	0.006	–	–	–	0.004

[a] Year 2012 factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Spokane County, Washington.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, Hp = horsepower, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-8. Annual Air Emissions for AGE Usages from Existing Aircraft at Fairchild AFB – KC-46A Project Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Year 2012										
10-50 Hp	0.04	0.17	0.24	0.01	0.03	0.02	30	0.00	0.00	31
76-100 Hp	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
101-175 Hp	1.20	8.70	10.17	0.29	1.35	1.25	1,350	0.21	0.01	1,359
176-300 Hp	0.00	0.02	0.04	0.00	0.00	0.00	5	0.00	0.00	5
Subtotal - Year 2012	**1.24**	**8.89**	**10.45**	**0.30**	**1.38**	**1.27**	**1,385**	**0.21**	**0.02**	**1,395**
Year 2016										
Subtotal - Year 2016[a]	**0.56**	**4.03**	**4.58**	**0.18**	**0.67**	**0.62**	**895**	**0.14**	**0.01**	**901**

Scenario/Source	Annual Emissions - Tons									
	Acetalde-hyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloroform	Chloro-methane	Dibutyl Phthalate	1,2-Dichloro-propane
Year 2012										
10-50 Hp	0.003	0.000	0.001	0.000	–	–	–	–	–	–
76-100 Hp	0.000	0.000	0.000	0.000	–	–	–	–	–	–
101-175 Hp	0.089	0.014	0.024	0.002	–	–	–	–	–	–
176-300 Hp	0.000	0.000	0.000	0.000	–	–	–	–	–	–
Subtotal - Year 2012	**0.092**	**0.014**	**0.025**	**0.002**	**–**	–	–	–	–	–
Year 2016										
Subtotal - Year 2016[a]	**0.04**	**0.01**	**0.01**	**0.001**	**–**	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	2,4-Dinitro-phenol	DEHP	Ethyl-benzene	Formalde-hyde	Hexane	Methanol	Methylene Chloride	MTBE	Naphth-alene	Phenol
Year 2012										
10-50 Hp	–	–	0.000	0.005	0.000	–	–	–	–	–
76-100 Hp	–	–	0.000	0.000	0.000	–	–	–	–	–
101-175 Hp	–	–	0.004	0.179	0.002	–	–	–	–	–
176-300 Hp	–	–	0.000	0.001	0.000	–	–	–	–	–
Subtotal - Year 2012	–	–	**0.004**	**0.185**	**0.002**	–	–	–	–	–
Year 2016										
Subtotal - Year 2016[a]	–	–	**0.002**	**0.08**	**0.001**	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	POM	Propionald-ehyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetrachlor-oethene	Toluene	1,1,1-Trichloro-ethane	Vinyl Acetate	mp-Xylene	o-Xylene
Year 2012										
10-50 Hp	0.000	0.000	0.000	–	–	0.001	–	–	–	0.000
76-100 Hp	0.000	0.000	0.000	–	–	0.000	–	–	–	0.000
101-175 Hp	0.000	0.012	0.001	–	–	0.018	–	–	–	0.013
176-300 Hp	0.000	0.000	0.000	–	–	0.000	–	–	–	0.000
Subtotal - Year 2012	**0.000**	**0.012**	**0.001**	–	–	**0.019**	–	–	–	**0.013**
Year 2016										
Subtotal - Year 2016[a]	**0.000**	**0.01**	**0.000**	–	–	**0.01**	–	–	–	**0.01**

[a] 2012 AGE emissions * (2016 existing aircraft LTOs / 2012 total existing LTOs) * (2016/2012 Nonroad EFs).

Key: – = Source does not emit particular pollutant, AGE = aerospace ground equipment, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EFs = emission factors, Hp = horsepower, LTO = landing and takeoff, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-9. Existing Aircraft On-Wing Engine Testing Activity Data for Altus AFB – Year 2012

Aircraft/Test Type	Tests/ Year[a]	# of Engines	Duration (Minutes)[a]	Engine Setting/Annual Engine Hours			
				Idle	*Approach*	*Intermediate*	*Takeoff*
KC-135							
60-HR INSPECTION	66	4	15	66.0	–	–	–
120-HR INSPECTION	66	4	15	66.0	–	–	–
Idle runs for maintenance	130	1	15	32.5	–	–	–
Idle runs for maintenance	104	2	15	52.0	–	–	–
Idle runs for maintenance	26	4	15	26.0	–	–	–
141 ARW EXPO SORTIE PREFLIGHT	445	4	10	296.4	–	–	–
141 ARW EXPO SORTIE POST-FLIGHT	445	4	6	177.8	–	–	–
DEFUELING	66	1	60	66.0	–	–	–
PREFLIGHT	1,027	4	10	684.7	–	–	–
POSTFLIGHT	1,027	2	5	171.2	–	–	–
HIGH POWER ENGINE RUNS	80	2	90	240.0	–	–	–
HIGH POWER ENGINE RUNS	80	2	15	–	40.0	–	–
HIGH POWER ENGINE RUNS	80	2	30	–	–	80.0	–
HIGH POWER ENGINE RUNS	80	2	15	–	–	–	40.0
Total Time In Modes - KC-135				**1,879**	**40**	**80**	**40**
UH-1M							
36 RQF UH-1N MX	30	2	30	30.0	–	–	–
36 RQF UH-1N Hovers - All	412	2	16	219.7	–	–	–
Total Time In Modes - KC-135				**250**	–	–	–
UH-60							
ARNG H-60 Preflight Hover	1,302	2	2	86.8	–	–	–
ARNG H-60 Hovers	66	2	15	33.0	–	–	–
ARNG H-60 MX PROCEDURE	78	2	35	91.0	–	–	–
Total Time In Modes - KC-135				**211**	–	–	–

[a] Source is SAIC 2013i.

Key: – = Source does not emit particular pollutant, # = number, ARNG = Air National Guard, ARW = Air Refueling Wing, hr = hour.

Table D.2-10. Emissions Factors by Engine Setting for Aircraft at Fairchild AFB – KC-46A MOB 1 Scenario

Engine/Setting	Fuel Flow (pounds/hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
CFM56-2B-1[b]											
Idle	1,014	2.10	30.70	4.00	1.06	0.06	0.06	3,216	0.09	0.10	3,249
Approach	2,463	0.09	4.20	8.20	1.06	0.06	0.06	3,216	0.09	0.10	3,249
Intermediate	6,486	0.06	0.09	16.00	1.06	0.05	0.05	3,216	0.09	0.10	3,249
Military	7,801	0.05	0.09	18.50	1.06	0.07	0.07	3,216	0.09	0.10	3,249
T400-CP-400[c]											
Warm-up	148	6.21	28.36	3.13	0.40	4.20	4.20	3,216	0.09	0.10	3,249
T700-GE-700[d]											
Taxi Out	308	0.66	16.01	4.85	0.40	4.20	4.20	3,216	0.09	0.10	3,249
P&W 4062[e]											
Idle	1,663	12.49	42.61	3.78	1.06	0.11	0.10	3,216	0.09	0.10	3,249
Approach	5,702	0.10	1.93	12.17	1.06	0.05	0.04	3,216	0.09	0.10	3,249
Intermediate	16,870	0.08	0.50	25.98	1.06	0.07	0.06	3,216	0.09	0.10	3,249
Military	21,622	0.09	0.61	34.36	1.06	0.08	0.07	3,216	0.09	0.10	3,249
KC-46A APU - Honeywell 331-400C[f]											
Pounds per Hour	N/A	0.04	0.33	6.72	0.56	0.05	0.04	1,373	0.04	0.04	1,387

Engine/Setting	Fuel Flow (pounds/hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Chloromethane	o-Cresol	p-Cresol
CFM56-2B-1[b]											
Idle	1,014	–	–	0.002	–	–	–	0.002	0.001	–	–
Approach	2,463	–	–	0.003	–	–	0.001	0.002	0.001	–	–
Intermediate	6,486	–	–	0.000	–	–	0.000	0.002	0.001	–	–
Military	7,801	–	–	0.001	–	–	–	0.001	0.000	–	–
T400-CP-400[c]											
Warm-up	148	0.018	0.007	0.049	–	0.000	0.000	0.001	–	0.001	0.121
T700-GE-700[d]		–	–	–	–	–	–	–	–	–	–
Taxi Out	308	0.018	0.007	0.049	–	0.000	0.000	0.001	–	0.001	0.121
P&W 4062[e]											
Idle	1,663	–	–	–	–	–	–	–	–	–	–
Approach	5,702	–	–	–	–	–	–	–	–	–	–
Intermediate	16,870	–	–	–	–	–	–	–	–	–	–
Military	21,622	–	–	–	–	–	–	–	–	–	–
KC-46A APU - Honeywell 331-400C[f]											
Pounds per Hour	N/A	–	–	–	–	–	–	–	–	–	–

Engine/Setting	Fuel Flow (pounds/hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		Dibenzofuran	Dibutyl Phthalate	1,2-Dichloropropane	2,4-Dinitrophenol	Di(2-Ethylhexyl) Phthalate (DEHP)	Ethylbenzene	Formaldehyde	Hexane	Methanol	Methylene Chloride
CFM56-2B-1[b]											
Idle	1,014	–	–	–	–	0.006	0.001	0.095	–	–	0.068
Approach	2,463	–	–	–	–	0.002	0.001	0.015	–	–	0.045
Intermediate	6,486	–	–	–	–	0.005	–	0.006	–	–	0.051
Military	7,801	–	–	–	–	0.002	–	0.007	–	–	0.002
T400-CP-400[c]											
Warm-up	148	0.000	0.000	–	–	0.001	0.002	0.219	–	–	0.011
T700-GE-700[d]											
Taxi Out	308	0.000	0.000	–	–	0.001	0.002	0.219	–	–	0.011
P&W 4062[e]											
Idle	1,663	–	–	–	–	–	–	–	–	–	–
Approach	5,702	–	–	–	–	–	–	–	–	–	–
Intermediate	16,870	–	–	–	–	–	–	–	–	–	–
Military	21,622	–	–	–	–	–	–	–	–	–	–
KC-46A APU - Honeywell 331-400C[f]											
Pounds per Hour	N/A	–	–	–	–	–	–	–	–	–	–

Table D.2-10. Emissions Factors by Engine Setting for Aircraft at Fairchild AFB – KC-46A MOB 1 Scenario (Continued)

Engine/Setting	Fuel Flow (pounds/hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		MIBK	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*
CFM56-2B-1 [b]											
Idle	1,014	–	–	0.003	–	–	–	0.001	–	0.002	0.009
Approach	2,463	–	–	–	–	–	–	–	–	0.003	0.006
Intermediate	6,486	–	–	–	–	–	–	–	–	0.000	0.001
Military	7,801	–	–	–	–	–	–	–	–	0.001	0.001
T400-CP-400 [c]											
Warm-up	148	0.001	–	0.007	0.006	–	–	0.005	–	–	0.013
T700-GE-700 [d]											
Taxi Out	308	0.001	–	0.007	0.006	–	–	0.005	–	–	0.013
P&W 4062 [e]											
Idle	1,663	–	–	–	–	–	–	–	–	–	–
Approach	5,702	–	–	–	–	–	–	–	–	–	–
Intermediate	16,870	–	–	–	–	–	–	–	–	–	–
Military	21,622	–	–	–	–	–	–	–	–	–	–
KC-46A APU - Honeywell 331-400C [f]											
Pounds per Hour	N/A	–	–	–	–	–	–	–	–	–	–

Engine/Setting	Fuel Flow (pounds/hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]				
		1,1,1-Trichloroethane	*Trichloro-ethene*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
CFM56-2B-1 [b]						
Idle	1,014	0.001	–	0.005	0.002	–
Approach	2,463	0.001	–	0.004	0.002	–
Intermediate	6,486	-	–	0.003	0.001	–
Military	7,801	0.000	–	0.002	0.000	–
T400-CP-400 [c]						
Warm-up	148	0.001	–	–	0.004	0.003
T700-GE-700 [d]						
Taxi Out	308	0.001	–	–	0.004	0.003
P&W 4062 [e]						
Idle	1,663	–	–	–	–	–
Approach	5,702	–	–	–	–	–
Intermediate	16,870	–	–	–	–	–
Military	21,622	–	–	–	–	–
KC-46A APU - Honeywell 331-400C [f]						
Pounds per Hour	N/A	–	–	–	–	–

[a] Data are for 1 engine.

[b] Data from Air Emissions Factor Guide to Air Force Mobile Sources (AFCEC 2013), except military data for the F117 engine from (AFCEE 2009).

[c] The UH-1 has two T400-CP-400 engines (AESO 2009c).

[d] The UH-60 has two T700-GE-700 engines (AESO 2011).

[e] ICAO Engine Exhaust Emissions Data Bank – Subsonic Engines – (ICAO 2013).

[f] Source is Boeing 2013a.

Key: APU = auxiliary power unit, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, hr = hour, ICAO = International Civil Aviation Organization, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, P&W = Pratt & Whitney, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-11. Annual Air Emissions from Existing Aircraft On-Wing Engine Testing Activities for Altus AFB – Year 2012

Scenario/ Engine Type	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
KC-135										
Idle	2.00	29.23	3.81	1.01	0.06	0.06	3,062	0.08	0.10	3,094
Approach	0.00	0.21	0.40	0.05	0.00	0.00	158	0.00	0.00	160
Intermediate	0.01	0.02	4.15	0.28	0.01	0.01	834	0.02	0.03	843
Military	0.01	0.01	2.89	0.17	0.01	0.01	502	0.01	0.02	507
Subtotal KC-135	**2.03**	**29.48**	**11.25**	**1.50**	**0.08**	**0.08**	**4,557**	**0.13**	**0.14**	**4,604**
UH-1M										
Warm-up	0.11	0.52	0.06	0.01	0.08	0.08	59	0.00	0.00	60
Subtotal KC-135	**0.11**	**0.52**	**0.06**	**0.01**	**0.08**	**0.08**	**59**	**0.00**	**0.00**	**60**
UH-60										
Taxi Out	0.02	0.52	0.16	0.01	0.14	0.14	104	0.00	0.00	105
Subtotal KC-135	**0.02**	**0.52**	**0.16**	**0.01**	**0.14**	**0.14**	**104**	**0.00**	**0.00**	**105**
Total Emissions - 2012	**2.17**	**30.52**	**11.47**	**1.52**	**0.30**	**0.30**	**4,721**	**0.13**	**0.15**	**4,769**

Scenario/ Engine Type	Annual Emissions - Tons						
	Acetaldehyde	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetrachloride*	*Chloroform*
KC-135							
Idle	–	–	0.002	–	–	–	0.002
Approach	–	–	0.000	–	–	0.000	0.000
Intermediate	–	–	0.000	–	–	0.000	0.000
Military	–	–	0.000	–	–	–	0.000
Subtotal KC-135	–	–	**0.002**	–	–	**0.000**	**0.003**
UH-1M							
Warm-up	0.000	0.000	0.001	–	0.000	0.000	0.000
Subtotal KC-135	**0.000**	**0.000**	**0.001**	–	**0.000**	**0.000**	**0.000**
UH-60							
Taxi Out	0.001	0.000	0.002	–	0.000	0.000	0.000
Subtotal KC-135	**0.001**	**0.000**	**0.002**	–	**0.000**	**0.000**	**0.000**
Total Emissions - 2012	**0.001**	**0.000**	**0.005**	–	**0.000**	**0.000**	**0.003**

Scenario/ Engine Type	Annual Emissions - Tons						
	Chloro-methane	*o-Cresol*	*p-Cresol*	*Dibenzofuran*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*
KC-135							
Idle	0.001	–	–	–	–	–	–
Approach	0.000	–	–	–	–	–	–
Intermediate	0.000	–	–	–	–	–	–
Military	0.000	–	–	–	–	–	–
Subtotal KC-135	**0.001**	–	–	–	–	–	–
UH-1M							
Warm-up	–	0.000	0.002	0.000	0.000	–	–
Subtotal KC-135	–	**0.000**	**0.002**	**0.000**	**0.000**	–	–
UH-60							
Taxi Out	–	0.000	0.004	0.000	0.000	–	–
Subtotal KC-135	–	**0.000**	**0.004**	**0.000**	**0.000**	–	–
Total Emissions - 2012	**0.001**	**0.000**	**0.006**	**0.000**	**0.000**	–	–

Table D.2-11. Annual Air Emissions from Existing Aircraft On-Wing Engine Testing Activities for Altus AFB – Year 2012 (Continued)

Scenario/ Engine Type	Annual Emissions - Tons						
	Di(2-Ethylhexyl) Phthalate (DEHP)	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MIBK*
KC-135							
Idle	0.005	0.001	0.091	–	–	0.064	–
Approach	0.000	0.000	0.001	–	–	0.002	–
Intermediate	0.001	–	0.001	–	–	0.013	–
Military	0.000	–	0.001	–	–	0.000	–
Subtotal KC-135	**0.007**	**0.001**	**0.094**	–	–	**0.080**	–
UH-1M							
Warm-up	0.000	0.000	0.004	–	–	0.000	0.000
Subtotal KC-135	**0.000**	**0.000**	**0.004**	–	–	**0.000**	**0.000**
UH-60							
Taxi Out	0.000	0.000	0.007	–	–	0.000	0.000
Subtotal KC-135	**0.000**	**0.000**	**0.007**	–	–	**0.000**	**0.000**
Total Emissions - 2012	**0.007**	**0.001**	**0.105**	–	–	**0.080**	**0.000**

Scenario/ Engine Type	Annual Emissions - Tons						
	MTBE	*Naphthalene*	*Phenol*	*POM*	*Propionalde-hyde*	*Styrene*	*1,1,2,2-Tetrachloro-ethane*
KC-135							
Idle	–	0.003	–	–	–	0.001	–
Approach	–	–	–	–	–	–	–
Intermediate	–	–	–	–	–	–	–
Military	–	–	–	–	–	–	–
Subtotal KC-135	–	**0.003**	–	–	–	**0.001**	–
UH-1M							
Warm-up	–	0.000	0.000	–	–	0.000	–
Subtotal KC-135	–	**0.000**	**0.000**	–	–	**0.000**	–
UH-60							
Taxi Out	–	0.000	0.000	–	–	0.000	–
Subtotal KC-135	–	**0.000**	**0.000**	–	–	**0.000**	–
Total Emissions - 2012	–	**0.003**	**0.000**	–	–	**0.002**	–

Scenario/ Engine Type	Annual Emissions - Tons						
	Tetrachloro-ethene	*Toluene*	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-135							
Idle	0.002	0.009	0.001	–	0.005	0.002	–
Approach	0.000	0.000	0.000	–	0.000	0.000	–
Intermediate	0.000	0.000	–	–	0.001	0.000	–
Military	0.000	0.000	0.000	–	0.000	0.000	–
Subtotal KC-135	**0.002**	**0.009**	**0.001**	–	**0.006**	**0.002**	–
UH-1M							
Warm-up	–	0.000	0.000	–	–	0.000	0.000
Subtotal KC-135	–	**0.000**	**0.000**	–	–	**0.000**	**0.000**
UH-60							
Taxi Out	–	0.000	0.000	–	–	0.000	0.000
Subtotal KC-135	–	**0.000**	**0.000**	–	–	**0.000**	**0.000**
Total Emissions - 2012	**0.002**	**0.010**	**0.001**	–	**0.006**	**0.002**	**0.000**

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-12. KC-46A Aircraft Landings and Take-offs at Fairchild AFB – KC-46A MOB 1 Scenario

Scenario/Operation	Operations per Year[a]	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		Idle	*Approach*	*Intermediate*	*Takeoff*	*Idle*	*Approach*	*Intermediate*	*Takeoff*
KC-46A - MOB 1									
LTO	2,815	47.7	5.2	1.6	0.7	2,238	244	75	33

[a] EIS Table 2-11.

Key: LTO = landing and takeoff, MOB 1 = First Main Operating Base.

Table D.2-13. KC-46A Aircraft Closed Pattern Operations at Fairchild AFB – KC-46A MOB 1 Scenario

Scenario/Operation	Operations per Year[a]	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	*60%*	*Climbout*	*Takeoff*	*55%*	*60%*	*Climbout*	*Takeoff*
MOB 1									
Closed Pattern - Radar & Initial to Overhead	6,415	12.0	2.0	–	1.0	1,283	214	–	107
Closed Pattern - VFR	4,357	5.0	2.0	–	1.0	363	145	–	73
Closed Pattern - Tactical	3,023	8.0	2.0	2.0	1.0	403	101	101	50
TIMs - KC-46A MOB 1						**2,049**	**460**	**101**	**230**

[a] EIS Table 2-11 and SAIC 2013l. Closed Pattern – Tactical ops reduced by 7.5% to reflect amount of time above 3,000 feet AGL.

Key: – = No activity, % = percent, AGL = above ground level, MOB 1 = First Main Operating Base, ops = operations, VFR = visual flight rules.

Table D.2-14. Annual Aircraft LTOs at Fairchild AFB – KC-46A Project Scenarios

Aircraft	Annual LTOs	
	2012	*MOB 1*
KC-135	1,474	–
UH-60	1,302	1,302
UH-1N	412	412
Transient	975	975
KC-46A	–	2,815
Total LTOs	**4,162**	**5,503**

Key: – = No activity, LTO = landing and takeoff, MOB 1 = First Main Operating Base.

Table D.2-15. Annual Average Nonroad Equipment Emission Factors – Fairchild AFB KC-46A Scenarios

HP Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
100-175 HP Diesel	0.54	3.92	4.58	0.13	0.61	0.56	608	0.094	0.007	612
Year 2016 MOB 1										
100-175 HP Diesel	0.38	2.75	3.11	0.12	0.46	0.42	608	0.094	0.007	612

HP Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Year 2012										
100-175 HP Diesel	0.040	0.006	0.011	0.001	–	–	–	–	–	–
Year 2016 MOB 1										
100-175 HP Diesel	0.028	0.004	0.008	0.001	–	–	–	–	–	–

HP Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Year 2012										
100-175 HP Diesel	–	–	0.002	0.081	0.001	–	–	–	–	–
Year 2016 MOB 1										
100-175 HP Diesel	–	–	0.001	0.057	0.001	–	–	–	–	–

HP Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	POM	*Propio-naldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2012										
100-175 HP Diesel	–	0.005	–	–	–	0.008	–	–	–	0.006
Year 2016 MOB 1										
100-175 HP Diesel	–	0.004	–	–	–	0.006	–	–	–	0.004

[a] Data estimated with the use of the EPA NONROAD 2008a model (USEPA 2009) for Spokane County, Washington.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, Hp = horsepower, MOB 1 = First Main Operating Base, N_2O = nitrous oxide, NO_x = nitrogen oxides, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-16. Annual Air Emissions for AGE Usages – Fairchild AFB KC-46A MOB 1 Scenario

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
Aerospace Ground Support Equipment	1.24	8.89	10.45	0.30	1.38	1.27	1,385	0.21	0.02	1,395
Subtotal - Year 2012	**1.24**	**8.89**	**10.45**	**0.30**	**1.38**	**1.27**	**1,385**	**0.21**	**0.02**	**1,395**
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.59	4.22	4.80	0.18	0.71	0.65	937.05	0.14	0.01	943
Subtotal - MOB 1 Scenario	**0.59**	**4.22**	**4.80**	**0.18**	**0.71**	**0.65**	**937**	**0.14**	**0.01**	**943**

Scenario/Source	Annual Emissions - Tons									
	Acetald-ehyde	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*
Year 2012										
Aerospace Ground Support Equipment	0.092	0.014	0.025	0.002	–	–	–	–	–	–
Subtotal - Year 2012	**0.092**	**0.014**	**0.025**	**0.002**	–	–	–	–	–	–
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.044	0.007	0.012	0.001	–	–	–	–	–	–
Subtotal - MOB 1 Scenario	**0.044**	**0.007**	**0.012**	**0.001**	–	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	2,4-Dinitro-phenol	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naphth-alene*	*Phenol*
Year 2012										
Aerospace Ground Support Equipment	–	–	0.004	0.185	0.002	–	–	–	–	–
Subtotal - Year 2012	–	–	**0.004**	**0.185**	**0.002**	–	–	–	–	–
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	–	–	0.002	0.088	0.001	–	–	–	–	–
Subtotal - MOB 1 Scenario	–	–	**0.002**	**0.088**	**0.001**	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	POM	**Propion-alde-hyde**	**Styrene**	**1,1,2,2-Tetra-chloro-ethane**	**Tetra-chloro-ethene**	**Toluene**	**1,1,1-Trichloro-ethane**	**Vinyl Acetate**	**mp-Xylene**	**o-Xylene**
Year 2012										
Aerospace Ground Support Equipment	0.000	0.012	0.001	–	–	0.019	–	–	–	0.013
Subtotal - Year 2012	**0.000**	**0.012**	**0.001**	–	–	**0.019**	–	–	–	**0.013**
Year 2016 - MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.000	0.006	0.000	–	–	0.009	–	–	–	0.006
Subtotal - MOB 1 Scenario	**0.000**	**0.006**	**0.000**	–	–	**0.009**	–	–	–	**0.006**

[a] 2012 AGE emissions * 2016 KC-46A LTOs / 2012 total LTOs * 2016/2012 Nonroad EFs.

Key: – = Source does not emit particular pollutant, AGE = aerospace ground equipment, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, Hp = horsepower, MOB 1 = First Main Operating Base, N_2O = nitrous oxide, NO_x = nitrogen oxides, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-17. Annual VMT for GMVs by Vehicle Class – Fairchild AFB Project Scenarios

VEH TYPE NAME	# of Vehicles	M/H/U/K CODE	FUEL TYPE	VEH WEIGHT	ANNUAL VMT
TRK DIGGER DERRICK MAIN	1	H	–	56,000	100
SDN LAW ENF	4	M	A	3,069	26,000
SDN CMPT 4PAX CL II	1	M	A	3,300	1,900
SDN CMPT 4PAX CL II	17	M	A	3,300	1,900
TRK 3/4T CREW CAB 4X2 PU	5	M	A	2,838	4,800
TRK 3/4T CREW CAB 4X4 PU	6	M	A	9,200	7,200
TRK 1/2T4X4 4600&5799GVW	2	M	A	7,999	2,800
TRK STK 4X2 1 T 7000 GVW	5	M	A	4,070	2,800
TRK CRL 4X2 8 PAX	1	M	A	4,800	3,700
TRK PU CMPT 4X2	6	M	A	2,400	3,600
TRK CRL 4X2 15 PAX	1	M	A	5,830	7,200
TRK CGO CMPT 4X4 3500G G	1	M	A	5,540	4,800
TRK CRL 4X2 7 PAX	13	M	A	4,800	4,800
Maint Utility Del Van	6	M	A	9,200	3,400
TRK UTILITY 4X4 4 DOOR	3	M	A	6,180	7,500
TRK 1/2T CREW CAB 4X4	2	M	A	6,180	4,800
Total VMT - Alternative Fuels					**87,300**
DEICER TRUCK MOUNTED	9	H	D	53,500	150
LAVATORY SERVICE TRUCK	1	H	D	9,300	100
STAIRCASE TRUCK	1	H	D	14,100	100
TRAC ACFT TWG MB-2	7	H	D	53,000	150
TRAC TOW SUPPORT EQP	7	H	D	9,320	300
FFTT 4X4	2	H	D	9,320	300
AMB MODULAR 4X4	2	M	D	10,190	5,000
BUS MTR 16PAX 4X2 DED/A12	3	M	D	14,050	800
BUS SCH 25-29 PAX 4X2 DE	3	M	D	26,500	3,000
BUS SCH 42&45 PAX 4X2 DE	6	M	D	16,954	8,500
TRK TK FUEL 1200 GL 4X2	3	H	D	16,700	200
TRK TK FUEL 1200 GL 4X4	1	H	D	16,700	200
TRK TRAC 6X4 MLOX 64-72K	1	M	D	58,000	5,600
TRK TK 6000 GAL R11 DED	8	H	D	23,960	550
TRK V HILFT 21000G 3T DE	1	M	D	21,560	100
TRK HI LIFT CGO 6X4 9T	1	M	Z	19,950	100
TRK MAINT 3/4T 4X4 GED	2	M	D	5,790	2,500
TRK 3/4T CREW CAB 4X2 PU	1	M	D	9,200	4,800
TRK 3/4T CREW CAB 4X4 PU	5	M	D	9,200	7,200
TRK DP 4X4 24M & 33999G	4	M	D	13,035	1,500
TRK V REFRGR 4X2 19000G	1	M	D	11,480	1,000
TRK CGO 4X4 17M&20999G G	1	M	D	11,955	3,600
TRK MAINT TEL-UT 4X2	23	M	D	5,900	5,000
TRK DP 24000-33000G 4X2	5	M	D	12,675	1,500
TRK STK 4X2 1 T 7000 GVW	5	M	D	8,500	2,800
TRK STK HI LIFT 3T	1	M	D	19,320	100
TRK HI REA 30&59 FT	1	H	D	33,000	200
TRK HYDRANT FUELING R-12	8	H	D	16,425	420
Maint Utility Del Van	4	M	D	6,400	3,400
TRK S&P 10000GVW 4X4	1	M	D	8,500	3,600
TRK WKR HYD TYPE 1 32000	1	M	D	22,430	1,200
TRK TRAC 6X4 39.5-43K GVW	1	M	D	13,780	3,600
TRK DP 44500GVW 6X4	3	M	D	46,000	1,200
TRUCK WRECKER TILT-BED	1	M	D	27,360	2,000
TRK HMMWV (M1165A1)	1	M	D	5,900	50
SEWER TRK SINGLE AXLE	1	H	D	12,940	300

Table D.2-17. Annual VMT for GMVs by Vehicle Class – Fairchild AFB Project Scenarios (Continued)

VEH TYPE NAME	# of Vehicles	M/H/U/K CODE	FUEL TYPE	VEH WEIGHT	ANNUAL VMT
HMMWV M1151A1	1	M	D	–	100
HMMWV M1165A1B3AFP	2	M	D	10,610	100
TRAC FTRACD SZ T7	1	H	D	39,865	200
TRAC WHLD IW70	2	H	D	7,275	120
TRAC W-BACKHOE / LOADER	2	H	D	17,730	150
LODR SCP PT 2 1-2&3 1-2C	1	H	D	29,300	300
LODR SCP PT 1 1-2 & 2 CY	2	H	D	21,701	300
LODR SCP PT 4CY	1	H	D	38,000	300
EXCAV WHL MTD HYD OP PT	1	H	D	50,108	100
GRADER SIZE 5	2	H	D	33,400	220
CRANE 18 T WHEEL IND	2	H	D	–	100
DISTR WTR TRK	1	M	D	17,690	1,200
SNO RML U MLTPU 3000 TPH	6	H	D	27,610	250
CLNR VAC TM SP MLTPUR AT	3	H	D	17,000	350
45K RVSBLE SNO PLOW	8	H	D	50,000	200
SNOW BROOM AND BLOWER	8	H	D	39,500	300
RLR RD TAND 2RL 2.5T	1	H	D	6,100	100
TRK FL 10K AT 463L	1	H	D	25,670	200
TRK FL 10K 463L	4	H	D	21,725	100
TUG WHSE 4K	1	H	D	7,000	100
TRK FL 4K DED	4	H	D	9,030	200
TRK FL DED 6M-6200 PT	1	H	D	10,920	100
TRK FL 15K	1	H	D	36,514	100
HALVORSEN ACFT LDR 25K	2	H	D	31,350	100
TRK FIRE PUMPER P-22	1	H	D	24,100	250
TRK FIRE PUMPER P-24	1	H	D	27,920	450
TRK FIRE CRS RESCUE P-19	2	H	D	24,310	200
TRK FIRE CRS RESCUE P-23	2	H	D	44,230	250
TRK WATER TANKER P-26	1	H	D	27,110	100
TRK FFGT HRV P-28	1	H	D	25,400	100
TRK FFGT HMV P-31 4X2	1	M	D	12,015	100
TRK FFGT QUINT P-33	1	H	D	24,100	100
Total VMT - Diesel Fuels					**77,960**
SDN CMPT 4PAX CL II	3	M	X	3,300	1,900
SDN CMPT 4PAX CL II	2	M	G	3,300	1,900
TRUCK 1/2T REG CAB 4X2	2	M	G	9,200	6,000
TRK MAINT 3/4T 4X4 GED	2	M	G	5,790	2,500
TRK 3/4T CREW CAB 4X2 PU	3	M	G	2,838	4,800
TRK 3/4T CREW CAB 4X4 PU	9	M	G	9,200	7,200
TRK 3/4T CREW CAB 4X2 PU	1	M	X	2,838	4,800
TRK STK 4X4 12500&16999G	2	M	G	9,600	3,000
TRK CGO 4X4 17M&20999G G	1	M	G	11,955	3,600
TRK MAINT TEL-UT 4X2	1	M	G	5,100	5,000
TRK 1/2T4X4 4600&5799GVW	3	M	G	7,999	2,800
TRK STK 4X2 1 T 7000 GVW	6	M	G	4,070	2,800
TRK CRL 4X2 8 PAX	2	M	G	4,800	3,700
TRK PU CMPT 4X2	15	M	G	5,540	3,600
TRK PNL 4X2 6999G / UNDE	3	M	G	6,824	3,700
TRK CRL 4X2 15 PAX	3	M	G	5,830	7,200
TRK CGO CMPT 4X4 3500G G	2	M	G	5,540	4,800
TRK CRL 4X2 7 PAX	4	M	G	2,838	4,800
Maint Utility Del Van	10	M	G	6,400	3,400
TRK S&P 4X2 10000 GVW	9	M	G	8,500	3,800
TRK S&P 10000GVW 4X4	2	M	G	8,500	3,600
TRK UTILITY 4X4 4 DOOR	2	M	G	9,200	7,500
TRK 1/2T CREW CAB 4X4	1	M	G	6,180	4,800
TUG WHSE 4K	1	H	G	7,000	100
Total VMT - Gasoline Fuels					**97,300**
TRK FL ELEC NARI 3000	2	H	N	8,780	200
TRK F/L ELEC SEATED 3K	1	H	V	–	120

Key: – = No activity, # = number, VEH = vehicle, VMT = vehicle miles traveled.

Table D.2-18. Annual Average On-Road Vehicle Emission Factors – Fairchild AFB KC-46A Scenarios

Scenario/Vehicle Class	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
CNG-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
LDGV - Road 3	0.05	2.38	0.36	0.01	0.02	0.01	321	0.0006	0.0001	321
LDGT1 - Road 3	0.13	4.85	0.86	0.01	0.04	0.02	448	0.0009	0.0002	448
LDDT - Road 3	0.40	1.82	2.82	–	0.38	0.02	443	0.0002	0.0002	444
HDGV - Road 3	0.13	4.85	0.86	0.01	0.04	0.02	448	0.0009	0.0002	448
HDDV - Road 3	0.42	2.51	10.68	0.01	0.56	0.50	1,949	0.0010	0.0009	1,949
Year 2016 FTU or MOB 1										
CNG-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
LDGV - Road 3	0.02	1.84	0.18	0.01	0.02	0.01	302	0.001	0.0001	302
LDGT1 - Road 3	0.10	4.26	0.70	0.01	0.04	0.02	413	0.001	0.0002	413
LDDT - Road 3	0.10	4.26	1.99	–	0.04	0.02	413	–	–	413
HDGV - Road 3	0.10	4.26	0.70	0.01	0.04	0.02	413	0.001	0.0002	413
HDDV - Road 3	0.25	1.57	6.63	0.01	0.36	0.30	1,949	0.001	0.001	1,949

[a] Factors estimated with the use of the EPA MOVES2010b model (USEPA 2013) for road 3 conditions and based on default parameters for Spokane County, Washington.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CNG = compressed natural gas, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, HDGV = heavy duty gasoline vehicle, LDDT = light duty diesel truck, LDGT = light duty gasoline truck, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-19. Annual Number of Workers at Fairchild AFB – KC-46A Project Scenarios

Scenario	Total # of Workers
Year 2012	5,835
Year 2016 MOB 1	6,273

Key: EIS = environmental impact statement; MOB 1 = First Main Operating Base.

Source: EIS Table 2-10.

Table D.2-20. Annual Emissions from GMV Activities – Fairchild AFB KC-46A Scenarios

Scenario/ Vehicle Class	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
Alternative-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
Diesel Vehicles	0.04	0.22	0.92	0.00	0.05	0.04	167.46	0.00	0.00	167.48
Gasoline Vehicles	0.01	0.52	0.09	0.00	0.00	0.00	48.09	0.00	0.00	48.10
Total	**0.05**	**0.74**	**1.01**	**0.00**	**0.05**	**0.04**	**215.55**	**0.00**	**0.00**	**215.59**
Year 2016 MOB 1[a]										
Alternative-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
Diesel Vehicles	0.02	0.14	0.61	0.00	0.03	0.03	180.05	0.00	0.00	180.07
Gasoline Vehicles	0.01	0.49	0.08	0.00	0.00	0.00	47.63	0.00	0.00	47.64
Total	**0.03**	**0.64**	**0.69**	**0.00**	**0.04**	**0.03**	**227.67**	**0.00**	**0.00**	**227.71**

[a] Year 2016 emissions = 2012 emissions * 2016 worker fraction of 2012 * year 2016 vehicle emission factor/ 2012 vehicle emission factor.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMV = government motor vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-21. Annual On Base On-Road Vehicle Mileage Calculations – Fairchild AFB KC-46A Project Scenarios

Scenario	# of Workers	Vehicle Occupancy Rate[a]	On-Base Miles per Round Trip	On-Base Miles per Day	On-Base Miles per year[b]
Year 2012	5,835	0.95	1.00	5,543	1,441,245
Year 2016 MOB 1	6,273	0.95	1.00	5,959	1,549,431

[a] Source is Washington State Department of Transportation 2012.

[b] Based on 260 days per year.

Key: # = number, MOB 1 = First Main Operating Base.

Table D.2-22. Annual Average On-Road Emission Factors – Fairchild AFB KC-46A Scenarios

Project Year/ Source Type	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV - Road 3	0.05	2.38	0.36	0.01	0.02	0.01	321	0.00	0.00	321
HDDV - Road 3	0.42	2.51	10.68	0.01	0.56	0.50	1,949	0.00	0.00	1,949
Composite[b]	0.06	2.38	0.57	0.01	0.03	0.02	354	0.00	0.00	354
Year 2016 MOB 1										
LDGV - Road 3	0.02	1.84	0.18	0.01	0.02	0.01	302	0.00	0.00	302
HDDV - Road 3	0.25	1.57	6.63	0.01	0.36	0.30	1,949	0.00	0.00	1,949
Composite[b]	0.02	1.84	0.31	0.01	0.03	0.02	335	0.00	0.00	335

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Spokane County.

[b] Equal to 98/2% LDGV/HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-23. Annual Emissions from On Base On-Road Vehicle Activities – Fairchild AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012	0.09	3.78	0.90	0.01	0.05	0.03	562	0.00	0.00	562
Year 2016 MOB 1	0.04	3.14	0.53	0.01	0.05	0.03	572	0.00	0.00	573

[a] Assumes that 2% of the fleet is HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, HDDV = heavy duty diesel vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-24. Annual Off Base On-Road Vehicle Mileage Calculations – Fairchild AFB KC-46A Scenarios

Scenario	# of Workers	Vehicle Occupancy Rate[a]	Off-Base Miles per 1-Way Trip[a]	Off-Base Miles per Day	On-Base Miles per year[b]
Year 2012	5,835	0.95	10.90	120,843	31,419,141
Year 2016 MOB 1	6,273	0.95	10.90	129,914	33,777,596

[a] Source: Washington State Department of Transportation 2012.

[b] Based on 260 days per year.

Key: # = number, MOB 1 = First Main Operating Base.

Table D.2-25. Annual Average On-Road Emission Factors – Fairchild AFB KC-46A Scenarios

Project Year/ Source Type	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV - Road 3	0.05	2.38	0.36	0.01	0.02	0.01	321	0.0006	0.0001	321
LDGV - Road 5	0.07	3.06	0.38	0.01	0.04	0.02	397	0.0008	0.0002	398
LDGV - Composite[b]	0.06	2.96	0.38	0.01	0.03	0.02	386	0.0008	0.0002	386
HDDV - Road 3	0.42	2.51	10.68	0.01	0.56	0.50	1,949	0.0010	0.0009	1,949
HDDV - Road 5	0.66	3.67	13.13	0.02	1.00	0.83	2,426	0.0012	0.0011	2,427
HDDV - Composite[b]	0.62	3.49	12.76	0.02	0.93	0.78	2,355	0.0012	0.0011	2,355
Year 2016 FTU										
LDGV - Road 3	0.02	1.84	0.18	0.01	0.02	0.01	302	0.0006	0.0001	302
LDGV - Road 5	0.03	2.35	0.18	0.01	0.04	0.01	374	0.0007	0.0002	374
LDGV - Composite[b]	0.03	2.22	0.18	0.01	0.03	0.01	356	0.0007	0.0001	356
HDDV - Road 3	0.25	1.57	6.63	0.01	0.36	0.30	1,949	0.0010	0.0009	1,949
HDDV - Road 5	0.40	2.29	8.24	0.02	0.67	0.51	2,427	0.0012	0.0011	2,427
HDDV - Composite[b]	0.37	2.11	7.84	0.02	0.59	0.46	2,307	0.0012	0.0011	2,308

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Spokane County, Washington.

[b] Equal to 15/85% road 3/road 5 conditions.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-26. Annual Emissions from Off-Base Vehicle Activities – Fairchild AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV	2.15	100.33	12.82	0.23	1.17	0.53	13,100.18	0.03	0.01	13,102.39
HDDV	0.43	2.42	8.84	0.01	0.64	0.54	1,630.96	0.00	0.00	1,631.22
Total	**2.58**	**102.75**	**21.66**	**0.24**	**1.81**	**1.07**	**14,731.15**	**0.03**	**0.01**	**14,733.61**
Year 2016 MOB 1										
LDGV	0.99	81.12	6.68	0.21	1.14	0.50	12,981.67	0.03	0.01	12,983.86
HDDV	0.27	1.57	5.84	0.01	0.44	0.34	1,718.06	0.00	0.00	1,718.32
Total	**1.27**	**82.69**	**12.52**	**0.22**	**1.58**	**0.84**	**14,699.73**	**0.03**	**0.01**	**14,702.18**

[a] Assumes that 2% of the fleet is HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-27. Annual Mobile Fuel Transfer Activities and VOC Emissions – Fairchild AFB KC-46A Scenarios

Scenario	Gallons per Year[a]	Tons per Year									
		VOC	*Benzene*	*Cumene*	*Ethyl-benzene*	*Hexane*	*MTBE*	*Naphth-alene*	*Toluene*	2,2,4-Tri-methyl-pentane	*Xylenes*
Year 2008 - Altus Refueling Truck to Aircraft	9,695,916	0.10	0.0006	0.0003	0.0002	0.0001	0.0005	0.0000	0.0011	0.0001	0.0017
Year 2012 - Fairchild AFB - Jet A Issue	14,852,636	0.15	0.0009	0.0004	0.0004	0.0001	0.0007	0.0000	0.0017	0.0002	0.0025
Year 2016 MOB 1	28,365,109	0.28	0.0018	0.0008	0.0007	0.0002	0.0014	0.0000	0.0032	0.0003	0.0048

[a] Altus data from 2008 AEI (Weston Solutions, Inc. 2008). Fairchild 2012 data (Fairchild Air Force Base 2013). Year 2016 MOB 1 throughput = 2012 gallons * KC-46A LTOs/year 2012 KC-135 LTOs.

[b] Future year emissions = 2008 emissions * future year gallons/2008 gallons.

Key: AEI = Air Emissions Inventory, LTO = landing and takeoff, MOB 1 = First Main Operating Base, VOC = volatile organic compound.

Table D.2-28. Annual Emissions from Point and Area Sources – Fairchild AFB KC-46A Scenarios

Scenario Year/ Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 - w/o NG or LPG	12.79	0.14	0.51	0.01	0.02	0.02	–	–	–	–
Year 2012 - NG	0.69	10.52	12.52	0.08	0.95	0.95	15,025	0.29	0.08	15,056
Year 2012 - LPG	0.00	0.02	0.04	0.00	0.00	0.00	34	0.00	0.00	35
Total - Year 2012[a]	**13.48**	**10.68**	**13.07**	**0.09**	**0.97**	**0.97**	**15,058**	**0**	**0**	**15,090**
Year 2016 MOB 1	**14.49**	**11.48**	**14.05**	**0.09**	**1.05**	**1.05**	**16,189**	**0**	**0**	**16,223**

[a] Year 2012 existing emissions provided by Fairchild AFB. Year 2016 emissions = 2012 emissions * 2016 worker fraction of 2012 workers.

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, LPG = liquefied petroleum gas, MOB 1 = First Main Operating Base, NG = natural gas, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound, w/o = without.

Table D.2-29. Annual Emissions for Existing Operations at Fairchild AFB – Year 2012

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
KC-135 Aircraft Operations	5.92	97.27	178.37	16.32	0.89	0.89	49,500	1.37	1.54	45,460
UH-60	0.98	8.68	3.03	0.25	2.02	2.02	2,350	0.07	0.07	2,159
UH-1N	0.16	1.08	0.83	0.07	0.73	0.73	555	0.02	0.02	510
Transient Aircraft Operations	4.25	22.46	64.48	5.43	2.44	2.44	15,406	0.43	0.48	14,148
On-Wing Aircraft Engine Testing - C-17	10.90	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	2.03	29.48	11.25	1.50	0.08	0.08	4,557	0.13	0.14	4,185
On-Wing Aircraft Engine Testing - UH-1M	0.11	0.52	0.06	0.01	0.08	0.08	59	0.00	0.00	55
On-Wing Aircraft Engine Testing - UH-60	0.02	0.52	0.16	0.01	0.14	0.14	104	0.00	0.00	96
Aerospace Ground Support Equipment	1.24	8.89	10.45	0.30	1.38	1.27	1,385	0.21	0.02	1,268
GMVs/Nonroad Equipment	0.05	0.74	1.01	0.00	0.05	0.04	216	0.00	0.00	196
Privately-Owned Vehicles - On-Base	0.09	3.78	0.90	0.01	0.05	0.03	562	0.00	0.00	511
Privately-Owned Vehicles - Off-Base	2.58	102.75	21.66	0.24	1.81	1.07	14,731	0.03	0.01	13,394
Mobile Fuel Transfer Operations	0.15	–	–	–	–	–	–	–	–	–
Point and Area Sources	13.48	10.68	13.07	0.09	0.97	0.97	15,058	0.29	0.08	13,718
Total Emissions	**41.96**	**286.84**	**305.27**	**24.22**	**10.65**	**9.77**	**104,484**	**2.54**	**2.36**	**95,699**

Source Type	Tons per Year									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
KC-135 Aircraft Operations	0.000	0.000	0.027	0.000	0.000	0.005	0.028	0.012	0.000	0.000
UH-60	0.004	0.002	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.027
UH-1N	0.001	0.001	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.008
Transient Aircraft Operations	0.010	0.012	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	0.000	0.000	0.002	0.000	0.000	0.000	0.003	0.001	0.000	0.000
On-Wing Aircraft Engine Testing - UH-1M	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002
On-Wing Aircraft Engine Testing - UH-60	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Aerospace Ground Support Equipment	0.092	0.014	0.025	0.002	0.000	0.000	0.000	0.000	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.001	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Emissions	**0.108**	**0.028**	**0.090**	**0.002**	**0.000**	**0.006**	**0.031**	**0.013**	–	–

Table D.2-29. Annual Emissions for Existing Operations at Fairchild AFB – Year 2012 (Continued)

Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*
KC-135 Aircraft Operations	–	0.000	0.000	0.00	0.00	0.05	0.00	0.35	0.00	0.00
UH-60	–	0.000	0.000	0.00	0.00	0.00	0.00	0.05	0.00	0.00
UH-1N	–	0.000	0.000	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Transient Aircraft Operations	–	0.000	0.000	0.00	0.00	0.00	0.00	0.06	0.00	0.00
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	0.000	0.000	0.000	0.000	0.007	0.001	0.094	0.000	0.000
On-Wing Aircraft Engine Testing - UH-1M	–	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
On-Wing Aircraft Engine Testing - UH-60	–	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Aerospace Ground Support Equipment	–	–	0.000	0.000	0.000	0.000	0.004	0.185	0.002	0.000
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.000	–	–	–	–	–	0.000	–	0.000	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Emissions	**0.000**	**–**	**0.000**	**0.000**	**0.000**	**0.058**	**0.012**	**0.768**	**0.002**	**0.000**

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propio-naldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*
KC-135 Aircraft Operations	0.70	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03
UH-60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UH-1N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transient Aircraft Operations	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	0.080	0.000	0.000	0.003	0.000	0.000	0.000	0.001	0.000	0.002
On-Wing Aircraft Engine Testing - UH-1M	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
On-Wing Aircraft Engine Testing - UH-60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aerospace Ground Support Equipment	0.000	–	0.000	0.000	0.000	0.000	0.012	0.001	0.000	0.000
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.001	0.000	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Emissions	**0.782**	**–**	**0.001**	**0.017**	**0.002**	**0.000**	**0.012**	**0.010**	**0.000**	**0.029**

Table D.2-29. Annual Emissions for Existing Operations at Fairchild AFB – Year 2012 (Continued)

Source Type	Tons per Year						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-135 Aircraft Operations	0.07	0.01	0.00	–	0.05	0.02	0.00
UH-60	0.00	0.00	0.00	–	0.00	0.00	0.00
UH-1N	0.00	0.00	0.00	–	0.00	0.00	0.00
Transient Aircraft Operations	0.01	0.00	0.00	–	0.00	0.00	0.00
On-Wing Aircraft Engine Testing - C-17	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	0.009	0.001	0.000	–	0.006	0.002	0.000
On-Wing Aircraft Engine Testing - UH-1M	0.000	0.000	0.000	–	0.000	0.000	0.000
On-Wing Aircraft Engine Testing - UH-60	0.000	0.000	0.000	–	0.000	0.000	0.000
Aerospace Ground Support Equipment	0.019	0.000		–	0.000	0.000	0.013
GMVs/Nonroad Equipment	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.002	–	–	0.000	–	–	0.003
Point and Area Sources	–	–	–	–	–	–	–
Total Emissions	**0.109**	**0.008**	**–**	**0.000**	**0.057**	**0.020**	**0.017**

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMV = government motor vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.2-30. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Fairchild AFB – Year 2016

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
KC-46A Aircraft Operations	50.07	201.74	837.57	45.42	2.92	2.49	136,814	3.79	4.25	125,648
On-Wing Aircraft Engine Testing - KC-46A	14.39	49.54	28.94	2.34	0.21	0.19	6,844	0.19	0.21	6,286
Aerospace Ground Support Equipment - KC-46A	0.59	4.22	4.80	0.18	0.71	0.65	937	0.14	0.01	858
UH-60 Aircraft Operations	0.91	8.00	2.21	0.20	1.50	1.50	1,952	0.05	0.06	1,793
UH-1N Aircraft Operations	0.14	0.68	0.26	0.02	0.24	0.24	184	0.01	0.01	169
Transient Aircraft	3.95	14.49	9.00	0.90	2.20	2.20	1,649	0.05	0.05	1,515
AGE - Existing Aircraft	0.56	4.03	4.58	0.18	0.67	0.62	895	0.14	0.01	819
On-Wing Aircraft Engine Testing - UH-1M	0.11	0.52	0.06	0.01	0.08	0.08	59	0.00	0.00	55
On-Wing Aircraft Engine Testing - UH-60	0.02	0.52	0.16	0.01	0.14	0.14	104	0.00	0.00	96
Government Motor Vehicles	0.03	0.64	0.69	0.00	0.04	0.03	228	0.00	0.00	207
Privately-Owned Vehicles - On-Base	0.04	3.14	0.53	0.01	0.05	0.03	572	0.00	0.00	521
Privately-Owned Vehicles - Off-Base	1.27	82.69	12.52	0.22	1.58	0.84	14,700	0.03	0.01	13,366
Mobile Fuel Transfer Operations	0.28	–	–	–	–	–	–	–	–	–
Point and Area Sources	14.49	11.48	14.05	0.09	1.05	1.05	16,189	0.31	0.09	14,748
Total Proposed Emissions - 2016	**86.86**	**381.69**	**915.36**	**49.58**	**11.36**	**10.04**	**181,128**	**4.71**	**4.71**	**166,078**
Year 2012 Base Case Emissions	**(41.96)**	**(286.84)**	**(305.27)**	**(24.22)**	**(10.65)**	**(9.77)**	**(104,484)**	**(2.54)**	**(2.36)**	**(95,699)**
Proposed Year 2016 minus Base Case Emissions	**44.90**	**94.84**	**610.10**	**25.36**	**0.72**	**0.27**	**76,644**	**2.17**	**2.35**	**70,379**
Spokane County PSD Thresholds	**250**	**250**	**250**	**250**	**250**	**250**				
Fractional Increase from Existing Conditions	**1.07**	**0.33**	**2.00**	**1.05**	**0.07**	**0.03**	**0.73**	**0.85**	**0.99**	**0.74**
Spokane County 2008 Emissions	**33,560**	**91,893**	**16,375**	**304**	**15,789**	**3,891**				**2,515,657**
Fractional Increase from Spokane Co Emissions	**0.001**	**0.001**	**0.04**	**0.08**	**0.0000**	**0.0001**				**0.03**

Table D.2-30. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Fairchild AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
KC-46A Aircraft Operations	2.16	1.24	0.85	0.85	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-46A	0.62	0.36	0.24	0.24	-	-	-	-		
Aerospace Ground Support Equipment - KC-46A	0.04	0.01	0.01	0.00	–	–	–	–	–	–
UH-60 Aircraft Operations	0.003	0.001	0.008	–	0.000	0.000	0.000	–	0.000	0.021
UH-1N Aircraft Operations	0.000	0.000	0.001	–	0.000	0.000	0.000	–	0.000	0.003
Transient Aircraft	0.009	0.011	0.017	–	–	–	–	–	–	–
AGE - Existing Aircraft	0.04	0.01	0.01	0.00	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UH-1M	0.000	0.000	0.001	–	0.000	0.000	0.000	–	0.000	0.002
On-Wing Aircraft Engine Testing - UH-60	0.001	0.000	0.002	–	0.000	0.000	0.000	–	0.000	0.004
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.00	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**2.877**	**1.618**	**1.147**	**1.099**	**0.000**	**0.000**	**0.000**	**-**	**0.000**	**0.030**
Year 2012 Base Case Emissions	**(0.108)**	**(0.028)**	**(0.090)**	**(0.002)**	**(0.000)**	**(0.006)**	**(0.031)**	**(0.013)**	**-**	**-**
Proposed Year 2016 minus Base Case Emissions	**2.769**	**1.590**	**1.057**	**1.097**	**(0.000)**	**(0.005)**	**(0.031)**	**(0.013)**	**0.000**	**0.030**
Spokane County PSD Thresholds										
Fractional Increase from Existing Conditions	**25.58**	**56.31**	**11.71**	**476.47**	**(0.31)**	**(0.98)**	**(0.99)**	**(1.00)**		
Spokane County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Spokane Co Emissions	–	–	–	–	–	–	–	–	–	–

Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*
KC-46A Aircraft Operations	–	–	–	–	–	–	0.09	6.22	–	0.91
On-Wing Aircraft Engine Testing - KC-46A	-		-	-	-	-	0.03	1.79	-	0.26
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	–	0.00	0.09	0.00	–
UH-60 Aircraft Operations	–	0.000	0.000	–	–	0.000	0.000	0.039	–	–
UH-1N Aircraft Operations	–	0.000	0.000	–	–	0.000	0.000	0.005	–	–
Transient Aircraft	–	–	–	–	–	–	0.002	0.060	–	–
AGE - Existing Aircraft	–	–	–	–	–	–	0.00	0.08	0.00	–
On-Wing Aircraft Engine Testing - UH-1M	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UH-60	–	0.000	0.000	–	–	0.000	0.000	0.004	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.00	–	–	–	–	–	0.00	–	0.00	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.001**	**0.000**	**0.000**	**-**	**-**	**0.000**	**0.120**	**8.283**	**0.002**	**1.174**
Year 2012 Base Case Emissions	**(0.000)**	**-**	**(0.000)**	**-**	**-**	**(0.058)**	**(0.012)**	**(0.768)**	**(0.002)**	**-**
Proposed Year 2016 minus Base Case Emissions	**0.000**	**0.000**	**(0.000)**	**-**	**-**	**(0.057)**	**0.108**	**7.516**	**(0.000)**	**1.174**
Spokane County PSD Thresholds										
Fractional Increase from Existing Conditions	**0.91**		**(0.32)**			**(0.99)**	**8.73**	**9.79**	**(0.02)**	
Spokane County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Spokane Co Emissions	–	–	–	–	–	–	–	–	–	–

Table D.2-30. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Fairchild AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro -ethane*	*Tetra-chloro-ethene*
KC-46A Aircraft Operations	–	–	–	0.27	0.37	–	–	0.16	–	–
On-Wing Aircraft Engine Testing - KC-46A	-		-	0.08	0.11	-	-	0.04	-	-
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	0.00	0.01	0.00	–	–
UH-60 Aircraft Operations	0.003	0.000	–	0.001	0.001	–	–	0.001	0.000	–
UH-1N Aircraft Operations	0.000	0.000	–	0.000	0.000	–	–	0.000	0.000	–
Transient Aircraft	–	–	–	0.005	–	–	–	0.003	–	–
AGE - Existing Aircraft	–	–	–	–	–	0.000	0.006	0.000	–	–
On-Wing Aircraft Engine Testing - UH-1M	–	–	–	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UH-60	0.000	0.000	–	0.000	0.000	–	–	0.000	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.001	0.000	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.004**	**0.000**	**0.001**	**0.359**	**0.473**	**0.000**	**0.011**	**0.206**	**0.000**	**-**
Year 2012 Base Case Emissions	**(0.782)**	**-**	**(0.001)**	**(0.017)**	**(0.002)**	**(0.000)**	**(0.012)**	**(0.010)**	**(0.000)**	**(0.029)**
Proposed Year 2016 minus Base Case Emissions	**(0.778)**	**0.000**	**0.001**	**0.341**	**0.472**	**(0.000)**	**(0.001)**	**0.196**	**(0.000)**	**(0.029)**
Spokane County PSD Thresholds										
Fractional Increase from Existing Conditions	**(1.00)**		**0.91**	**19.61**	**244.33**	**(0.07)**	**(0.07)**	**19.57**	**(0.33)**	**(1.00)**
Spokane County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Spokane Co Emissions	–	–	–	–	–	–	–	–	–	–

Source Type	Tons per Year						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-46A Aircraft Operations	0.32	–	–	–	–	0.14	0.08
On-Wing Aircraft Engine Testing - KC-46A	0.09	-		-	-	0.04	0.02
Aerospace Ground Support Equipment - KC-46A	0.01	–	–	–	–	–	0.01
UH-60 Aircraft Operations	0.002	0.000	0.000	–	–	0.001	0.001
UH-1N Aircraft Operations	0.000	0.000	0.000	–	–	0.000	0.000
Transient Aircraft	0.008	–	–	–	–	–	–
AGE - Existing Aircraft	0.008	–	–	–	–	–	0.006
On-Wing Aircraft Engine Testing - UH-1M	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UH-60	0.000	0.000	–	–	–	0.000	0.000
Government Motor Vehicles	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.003	–	–	0.000	–	–	0.005
Point and Area Sources	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.449**	**0.000**	**0.000**	**0.000**	**-**	**0.185**	**0.126**
Year 2012 Base Case Emissions	**(0.109)**	**(0.008)**	**-**	**(0.000)**	**(0.057)**	**(0.020)**	**(0.017)**
Proposed Year 2016 minus Base Case Emissions	**0.340**	**(0.008)**	**0.000**	**0.000**	**(0.057)**	**0.165**	**0.109**
Spokane County PSD Thresholds							
Fractional Increase from Existing Conditions	**3.12**	**(0.97)**		**0.91**	**(1.00)**	**8.19**	**6.54**
Spokane County 2008 Emissions	–	–	–	–	–	–	–
Fractional Increase from Spokane Co Emissions	–	–	–	–	–	–	–

Key: ( ) = parenthesis indicate negative numbers, – = Source does not emit particular pollutant, AGE = aerospace ground equipment, CH_4 = methane, CO = carbon monoxide, Co = County, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PM_{10} = particulate matter less than 10 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, VOC = volatile organic compound.

D.3 GRAND FORKS AIR FORCE BASE REGIONAL CLIMATE

Grand Forks AFB has a continental climate characterized by warm and wet summers and cold and relatively dry winters. Meteorological data collected at the Grand Forks International Airport are used to describe the climatic conditions of the Grand Forks AFB project region (NOAA 1998, 2013a).

Temperature. The average high and low temperatures during the summer months at Grand Forks International Airport range from about 81 °F to 57 °F. The average high and low temperatures during the winter months range from 34 °F to -3 °F.

Precipitation. Average annual precipitation at Grand Forks AFB is 20.8 inches. Precipitation is greatest during the warmer months of the year, and the peak monthly average of 3.5 inches occurs in June. Precipitation is at a minimum during the winter, as the lowest monthly average of 0.5 inches occurs in February. Snow is common during the colder months of the year; the average annual snowfall is 47.0 inches.

Prevailing Winds. The winds at Grand Forks AFB prevail from the north-northwest sector during the colder months of the year and they have a secondary maximum from the south-southeast (NDSCO 2013). The Grand Forks AFB region experiences breezy conditions, as the average wind speed for each month of the year is at least 8 miles per hour and the annual average wind speed is 9.4 miles per hour (NOAA 1998). The peak average monthly winds of 10 miles per hour occur from the months of October through April.

D.3.1 OPERATIONS EMISSION CALCULATIONS FOR THE KC-46A PROJECT SCENARIOS AT GRAND FORKS AFB

Table D.3-1. Aircraft Engine Emission Factors by Throttle Setting – RQ-4 and KC-46A Aircraft – Grand Forks AFB

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Allison AE3007[b]											
Idle	428	–	17.31	3.82	1.06	0.15	0.15	3,216	0.09	0.10	3,249
Approach	947	–	3.27	7.77	1.06	0.22	0.22	3,216	0.09	0.10	3,249
Intermediate	2,532	–	0.83	17.43	1.06	0.24	0.24	3,216	0.09	0.10	3,249
Military	3,021	–	0.83	20.50	1.06	0.27	0.27	3,216	0.09	0.10	3,249
TPE331-10GD											
Idle	–	–	–	–	–	–	–	3,216	0.09	0.10	3,249
Approach	–	–	–	–	–	–	–	3,216	0.09	0.10	3,249
Intermediate	–	–	–	–	–	–	–	3,216	0.09	0.10	3,249
Military	–	–	–	–	–	–	–	3,216	0.09	0.10	3,249
P&W 4062[c]											
Idle	1,663	12.49	42.61	3.78	1.06	0.11	0.10	3,216	0.09	0.10	3,249
Approach	5,702	0.10	1.93	12.17	1.06	0.05	0.04	3,216	0.09	0.10	3,249
Climbout	16,870	0.08	0.50	25.98	1.06	0.07	0.06	3,216	0.09	0.10	3,249
Take-off	21,622	0.09	0.61	34.36	1.06	0.08	0.07	3,216	0.09	0.10	3,249

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		Acetalde-hyde	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Allison AE3007[b]											
Idle	428	0.119	0.067	0.047	0.047	–	–	–	–	–	–
Approach	947	0.030	0.017	0.012	0.012	–	–	–	–	–	–
Intermediate	2,532	0.013	0.007	0.005	0.005	–	–	–	–	–	–
Military	3,021	0.013	0.007	0.005	0.005	–	–	–	–	–	–
TPE331-10GD											
Idle	–	–	–	–	–	–	–	–	–	–	–
Approach	–	–	–	–	–	–	–	–	–	–	–
Intermediate	–	–	–	–	–	–	–	–	–	–	–
Military	–	–	–	–	–	–	–	–	–	–	–
P&W 4062[c]											
Idle	1,663	–	–	–	–	–	–	–	–	–	–
Approach	5,702	–	–	–	–	–	–	–	–	–	–
Climbout	16,870	–	–	–	–	–	–	–	–	–	–
Take-off	21,622	–	–	–	–	–	–	–	–	–	–

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*
Allison AE3007[b]											
Idle	428	–	–	–	–	–	–	0.006	0.341	–	0.050
Approach	947	–	–	–	–	–	–	0.001	0.087	–	0.013
Intermediate	2,532	–	–	–	–	–	–	0.001	0.037	–	0.005
Military	3,021	–	–	–	–	–	–	0.001	0.037	–	0.005
TPE331-10GD											
Idle	–	–	–	–	–	–	–	–	–	–	–
Approach	–	–	–	–	–	–	–	–	–	–	–
Intermediate	–	–	–	–	–	–	–	–	–	–	–
Military	–	–	–	–	–	–	–	–	–	–	–
P&W 4062[c]											
Idle	1,663	–	–	–	–	–	–	–	–	–	–
Approach	5,702	–	–	–	–	–	–	–	–	–	–
Climbout	16,870	–	–	–	–	–	–	–	–	–	–
Take-off	21,622	–	–	–	–	–	–	–	–	–	–

Table D.3-1. Aircraft Engine Emission Factors by Throttle Setting – RQ-4 and KC-46A Aircraft – Grand Forks AFB (Continued)

Engine Type/ Throttle Setting	Fuel Flow (Pounds/ Hour)	Emission Factors (Pounds/1000 Pounds Fuel)[a]									
		Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro -ethane*	*Tetra-chloro-ethene*
Allison AE3007[b]											
Idle	428	–	–	–	0.014	0.019	–	0.019	0.008	–	–
Approach	947	–	–	–	0.004	0.005	–	0.005	0.002	–	–
Intermediate	2,532	–	–	–	0.002	0.002	–	0.002	0.001	–	–
Military	3,021	–	–	–	0.002	0.002	–	0.002	0.001	–	–
TPE331-10GD											
Idle	–	–	–	–	–	–	–	–	–	–	–
Approach	–	–	–	–	–	–	–	–	–	–	–
Intermediate	–	–	–	–	–	–	–	–	–	–	–
Military	–	–	–	–	–	–	–	–	–	–	–
P&W 4062[c]											
Idle	1,663	–	–	–	–	–	–	–	–	–	–
Approach	5,702	–	–	–	–	–	–	–	–	–	–
Climbout	16,870	–	–	–	–	–	–	–	–	–	–
Take-off	21,622	–	–	–	–	–	–	–	–	–	–

Engine Type/ Throttle Setting	Emission Factors (Pounds/1000 Pounds Fuel)[a]						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	2,2,4 Trimethyl-pentane	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Allison AE3007[b]							
Idle	0.017	–	–	–	–	0.008	0.006
Approach	0.004	–	–	–	–	0.002	0.001
Intermediate	0.002	–	–	–	–	0.001	0.001
Military	0.002	–	–	–	–	0.001	0.001
TPE331-10GD							
Idle	–	–	–	–	–	–	–
Approach	–	–	–	–	–	–	–
Intermediate	–	–	–	–	–	–	–
Military	–	–	–	–	–	–	–
P&W 4062[c]							
Idle	–	–	–	–	–	–	–
Approach	–	–	–	–	–	–	–
Climbout	–	–	–	–	–	–	–
Take-off	–	–	–	–	–	–	–

[a] Data are for 1 engine. The MQ-9 and RQ-4 have 1 engine each.

[b] Data for the RQ-4A from Air Emissions Factor Guide to Air Force Mobile Sources (AFCEC 2013).

[c] ICAO Engine Exhaust Emissions Data Bank – Subsonic Engines – (ICAO 2013)

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, ICAO = International Civil Aviation Organization, NO_x = nitrogen oxides, N_2O = nitrous oxide, P&W = Pratt & Whitney, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-2. Land and Take-off/Touch and Go Times in Modes and Fuel Usages – RQ-4 and KC-46A Aircraft

Aircraft/Mode (Engine Throttle Setting)	LTO			TGO	
	Time in Mode (TIM)		*Fuel Usage*	*TIM*	*Fuel Usage*
	(Minutes)	*(Hours)*	*(Pounds)*[a]	*(Hours)*	*(Pounds)*[a]
RQ-4 Global Hawk [b]					
Taxi Out (Idle)	9.2	0.15	66	–	–
Take-off (Military)	0.5	0.01	25	0.01	25
Climbout (Intermediate)	1.4	0.02	59	0.02	59
Approach	4.0	0.07	63	0.07	63
Taxi In (Idle)	6.7	0.11	48	–	–
Totals	**21.8**	**0.36**	**261**	**0.10**	**147**
KC-46A [c]					
Taxi Out (Idle)	32.8	0.55	1,818	–	–
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	1.6	0.03	900	0.03	900
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826	–	–
Totals	**55.2**	**0.92**	**5,037**	**0.13**	**2,393**

[a] Fuel usage per aircraft for the RQ-4 as no data available for the MQ-9.

[b] TIM data from Table 2-4 for trainer-turbine, USAF general (AFCEC 2013).

[c] TIM data from Table 2-4 for the KC-135 (AFCEC 2013).

Key: – = No activity, LTO = landing and takeoff, TGO = touch and go, TIM = Time in Mode, USAF = United States Air Force.

Table D.3-3. Total Fuel Usage and Emissions PER LTO/TGO Cycle – RQ-4 and KC-46A Aircraft

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
LTO											
RQ-4 Global Hawk	261	0.4	2.2	2.5	0.3	0.1	0.1	839	0.02	0.03	847
KC-46A	5,037	33.2	115.3	62.7	5.3	0.4	0.4	16,199	0.45	0.50	16,365
TGO											
RQ-4 Global Hawk	147	0.1	0.3	2.0	0.2	0.0	0.0	474	0.01	0.01	479
KC-46A	2,393	0.2	2.7	52.7	2.5	0.2	0.1	7,695	0.21	0.24	7,773

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
LTO											
RQ-4 Global Hawk	261	0.017	0.009	0.007	0.007	0.000	0.000	0.000	0.000	0.000	0.000
KC-46A	5,037	–	–	–	–	–	–	–	–	–	–
TGO											
RQ-4 Global Hawk	147	0.003	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
KC-46A	2,393	–	–	–	–	–	–	–	–	–	–

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*
LTO											
RQ-4 Global Hawk	261	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.047	0.000	0.007
KC-46A	5,037	–	–	–	–	–	–	–	–	–	–
TGO											
RQ-4 Global Hawk	147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.001
KC-46A	2,393	–	–	–	–	–	–	–	–	–	–

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)									
		Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propionald ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetrachlor-oethene*
LTO											
RQ-4 Global Hawk	261	0.000	0.000	0.000	0.002	0.003	0.000	0.003	0.001	0.000	0.000
KC-46A	5,037	–	–	–	–	–	–	–	–	–	–
TGO											
RQ-4 Global Hawk	147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KC-46A	2,393	–	–	–	–	–	–	–	–	–	–

Aircraft/Mode	Fuel Usage (Pounds)	Emissions (Pounds)						
		Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
LTO								
RQ-4 Global Hawk	261	0.002	0.000	0.000	0.000	0.000	0.001	0.001
KC-46A	5,037	–	–	–	–	–	–	–
TGO								
RQ-4 Global Hawk	147	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KC-46A	2,393	–	–	–	–	–	–	–

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, LTO = landing and takeoff, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, TGO = touch and go, VOC = volatile organic compound.

Table D.3-4. Annual Air Operations for Aircraft at Altus AFB – Year 2008

Aircraft	Number of Operations				
	LTO	*TGO*	*LFB*	*LFP*	*Total*
C-17	17,052	35,092	–	35,092	**87,236**
KC-135	6,702	44,520	–	44,520	**95,742**
Transient	195	–	–	–	**195**

Key: – = No activity, LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: 2008 Mobile Source Air Emissions Inventory for Grand Forks Air Force Base (Weston Solutions, Inc. 2008).

Table D.3-5. Annual Air Operations for Aircraft at Grand Forks AFB – Year 2012

Aircraft	Number of Operations				
	LTO	*TGO*	*LFB*	*LFP*	*Total*
MQ-9 Reaper	416	–	–	6,734	**7,150**
RQ-4 Global Hawk	130	–	–	65	**195**
Transient	128	–	–	–	**128**

Key: – = No activity, LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: SAIC 2013j.

Table D.3-6. Existing Aircraft Closed Pattern Operations at Grand Forks AFB – KC-46A Proposed Scenarios

Aircraft Type/Operation	Operations per Year	Engine Setting/Time in Mode (Minutes)				Engine Setting Annual Hours			
		Approach	*Intermediate*	*Climbout*	*Takeoff*	*Approach*	*Intermediate*	*Climbout*	*Takeoff*
MQ-9 Reaper/RQ-4 Global Hawk									
Closed Pattern - Radar & Initial to Overhead	3,400	12.0	2.0	–	1.0	680	113	–	57
Closed Pattern - VFR	3,400	5.0	2.0	–	1.0	283	113	–	57
Closed Pattern - Tactical	–	8.0	2.0	2.0	1.0	–	–	–	–
Total TIMs						**963**	**227**	**–**	**113**

Key: – = No activity, TIM = Time in Mode, VFR = visual flight rules.

Table D.3-7. Annual Air Emissions from Existing Aircraft Operations – Grand Forks AFB Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Altus AFB - Year 2008										
Transient Aircraft Operations	0.79	2.90	1.80	0.18	0.44	0.44	330	0.01	0.01	333
Grand Forks Year 2012 - LTOs										
MQ-9 Reaper/RQ-4 Global Hawk	0.10	0.61	0.67	0.08	0.01	0.01	229	0.01	0.01	231
Transient Aircraft Operations	0.52	1.90	1.18	0.12	0.29	0.29	217	0.01	0.01	219
Subtotal - Year 2012 LTOs	**0.62**	**2.52**	**1.86**	**0.19**	**0.30**	**0.30**	**446**	**0.01**	**0.01**	**450**
2012 Closed Patterns - Reaper/Global Hawk										
Approach	0.32	1.49	3.54	0.48	0.10	0.10	1,467	0.04	0.05	1,482
Intermediate	0.09	0.24	5.00	0.30	0.07	0.07	923	0.03	0.03	932
Military	0.05	0.14	3.51	0.18	0.05	0.05	550	0.02	0.02	556
Transient Aircraft Operations	–	–	–	–	–	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	**0.46**	**1.87**	**12.05**	**0.97**	**0.22**	**0.22**	**2,940**	**0.08**	**0.09**	**2,970**
Total Year 2012	**1.08**	**4.39**	**13.91**	**1.16**	**0.52**	**0.52**	**3,386**	**0.09**	**0.11**	**3,420**
Total UAS Operations	**0.56**	**2.48**	**12.73**	**1.04**	**0.23**	**0.23**	**3,169**	**0.09**	**0.10**	**3,201**
Total Transient Aircraft Operations	**0.52**	**1.90**	**1.18**	**0.12**	**0.29**	**0.29**	**217**	**0.01**	**0.01**	**219**

Table D.3-7. Annual Air Emissions from Existing Aircraft Operations – Grand Forks AFB Scenarios (Continued)

Scenario/Source	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Altus AFB - Year 2008										
Transient Aircraft Operations	0.002	0.002	0.003	–	–	–	–	–	–	–
Grand Forks Year 2012 - LTOs										
MQ-9 Reaper/RQ-4 Global Hawk	0.005	0.003	0.002	0.002	–	–	–	–	–	–
Transient Aircraft Operations	0.001	0.001	0.002	–	–	–	–	–	–	–
Subtotal - Year 2012 LTOs	0.006	0.004	0.004	0.002	–	–	–	–	–	–
2012 Closed Patterns - Reaper/Global Hawk										
Approach	0.014	0.008	0.005	0.005	–	–	–	–	–	–
Intermediate	0.004	0.002	0.001	0.001	–	–	–	–	–	–
Military	0.002	0.001	0.001	0.001	–	–	–	–	–	–
Transient Aircraft Operations	–	–	–	–	–	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	**0.020**	**0.011**	**0.008**	**0.008**	–	–	–	–	–	–
Total Year 2012	**0.026**	**0.015**	**0.012**	**0.010**	–	–	–	–	–	–
Total UAS Operations	**0.024**	**0.014**	**0.010**	**0.010**	–	–	–	–	–	–
Total Transient Aircraft Operations	**0.001**	**0.001**	**0.002**	–	–	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*
Altus AFB - Year 2008										
Transient Aircraft Operations	–	–	–	–	–	–	0.000	0.012	–	–
Grand Forks Year 2012 - LTOs										
MQ-9 Reaper/RQ-4 Global Hawk	–	–	–	–	–	–	0.000	0.013	–	0.002
Transient Aircraft Operations	–	–	–	–	–	–	0.000	0.008	–	–
Subtotal - Year 2012 LTOs	–	–	–	–	–	–	0.000	0.021	–	0.002
2012 Closed Patterns - Reaper/Global Hawk										
Approach	–	–	–	–	–	–	0.001	0.040	–	0.006
Intermediate	–	–	–	–	–	–	0.000	0.011	–	0.002
Military	–	–	–	–	–	–	0.000	0.006	–	0.001
Transient Aircraft Operations	–	–	–	–	–	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	–	–	–	–	–	–	**0.001**	**0.057**	–	**0.008**
Total Year 2012	–	–	–	–	–	–	**0.001**	**0.078**	–	**0.010**
Total UAS Operations	–	–	–	–	–	–	**0.001**	**0.070**	–	**0.010**
Total Transient Aircraft Operations	–	–	–	–	–	–	**0.000**	**0.008**	–	–

Table D.3-7. Annual Air Emissions from Existing Aircraft Operations – Grand Forks AFB Scenarios (Continued)

Scenario/Source	Annual Emissions - Tons									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propionald-ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetrachlor-oethene*
Altus AFB - Year 2008										
Transient Aircraft Operations	–	–	–	0.001	–	–	–	0.001	–	–
Grand Forks Year 2012 - LTOs										
MQ-9 Reaper/RQ-4 Global Hawk	–	–	–	0.001	0.001	–	0.001	0.000	–	–
Transient Aircraft Operations	–	–	–	0.001	0.000	–	–	0.000	–	–
Subtotal - Year 2012 LTOs	–	–	–	0.001	0.001	–	0.001	0.001	–	–
2012 Closed Patterns - Reaper/Global Hawk										
Approach	–	–	–	0.002	0.002	–	0.002	0.001	–	–
Intermediate	–	–	–	0.000	0.001	–	0.001	0.000	–	–
Military	–	–	–	0.000	0.000	–	0.000	0.000	–	–
Transient Aircraft Operations	–	–	–	–	–	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	–	–	–	**0.002**	**0.003**	–	**0.003**	**0.001**	–	–
Total Year 2012	–	–	–	**0.003**	**0.004**	–	**0.004**	**0.002**	–	–
Total UAS Operations	–	–	–	**0.003**	**0.004**	–	**0.004**	**0.002**	–	–
Total Transient Aircraft Operations	–	–	–	**0.001**	–	–	–	**0.000**	–	–

Scenario/Source	*Annual Emissions - Tons*						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Altus AFB - Year 2008							
Transient Aircraft Operations	0.002	–	–	–	–	–	–
Grand Forks Year 2012 - LTOs							
MQ-9 Reaper/RQ-4 Global Hawk	0.001	–	–	–	–	0.000	0.000
Transient Aircraft Operations	0.001	–	–	–	–	–	–
Subtotal - Year 2012 LTOs	0.002	–	–	–	–	0.000	0.000
2012 Closed Patterns - Reaper/Global Hawk							
Approach	0.002	–	–	–	–	0.001	0.001
Intermediate	0.001	–	–	–	–	0.000	0.000
Military	0.000	–	–	–	–	0.000	0.000
Transient Aircraft Operations	–	–	–	–	–	–	–
Subtotal - Year 2012 Closed Patterns	**0.003**	–	–	–	–	**0.001**	**0.001**
Total Year 2012	**0.004**	–	–	–	–	**0.002**	**0.001**
Total UAS Operations	**0.003**	–	–	–	–	**0.002**	**0.001**
Total Transient Aircraft Operations	**0.001**	–	–	–	–	–	–

Key: – = Source does not emit particular pollutant, AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, LTO = landing and takeoff, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, UAS = Unmanned Aircraft System, VOC = volatile organic compound.

Table D.3-8. Annual Average Nonroad Emission Factors – Fairchild AFB and Grand Forks AFB

Hp Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 - Fairchild AFB										
Nonroad Equipment - 25-40 Hp	0.70	3.43	4.87	0.13	0.50	0.46	609	0.094	0.007	613
Nonroad Equipment - 41-50 Hp	0.50	2.56	4.93	0.13	0.45	0.41	610	0.094	0.007	614
Nonroad Equipment - 51-75 Hp	0.48	2.52	4.90	0.13	0.44	0.40	611	0.094	0.007	615
Nonroad Equipment - 76-100 Hp	0.52	3.68	4.61	0.13	0.53	0.49	607	0.094	0.007	611
Nonroad Equipment - 101-175 Hp	0.54	3.92	4.58	0.13	0.61	0.56	608	0.094	0.007	612
Nonroad Equipment - 176-300 Hp	0.38	1.72	4.09	0.11	0.38	0.35	547	0.094	0.007	551
Year 2016 Grand Forks AFB										
Nonroad Equipment - 101-175 Hp	0.38	2.75	3.11	0.12	0.46	0.42	608	0.094	0.007	613

[a] Factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Spokane County 2012 and Grand Forks County 2016.

Key: AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, Hp = horsepower, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-9. Annual Air Emissions for Existing AGE Usages – Grand Forks AFB KC-46A Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 - Fairchild AFB										
10-50 Hp	0.04	0.17	0.24	0.01	0.03	0.02	30.48	0.00	0.00	31
76-100 Hp	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0
101-175 Hp	1.20	8.70	10.17	0.29	1.35	1.25	1,349.72	0.21	0.01	1,359
176-300 Hp	0.00	0.02	0.04	0.00	0.00	0.00	4.91	0.00	0.00	5
Subtotal - Year 2012 Fairchild AFB	**1.24**	**8.89**	**10.45**	**0.30**	**1.38**	**1.27**	**1,385.37**	**0.21**	**0.02**	**1,395**
Subtotal - Year 2012 Grand Forks AFB[a]	**0.06**	**0.44**	**0.52**	**0.01**	**0.07**	**0.06**	**69.27**	**0.01**	**0.00**	**70**
Subtotal - Year 2016 Grand Forks AFB[b]	**0.04**	**0.31**	**0.35**	**0.01**	**0.05**	**0.05**	**69.33**	**0.01**	**0.00**	**70**

Scenario/Source	Annual Emissions - Tons									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Year 2012 - Fairchild AFB										
10-50 Hp	0.003	0.00	0.00	0.00	–	–	–	–	–	–
76-100 Hp	0.000	0.00	0.00	0.00	–	–	–	–	–	–
101-175 Hp	0.089	0.01	0.02	0.00	–	–	–	–	–	–
176-300 Hp	0.000	0.00	0.00	0.00	–	–	–	–	–	–
Subtotal - Year 2012 Fairchild AFB	**0.092**	**0.01**	**0.025**	**0.002**	–	–	–	–	–	–
Subtotal - Year 2012 Grand Forks AFB[a]	**0.005**	**0.001**	**0.001**	**0.000**	–	–	–	–	–	–
Subtotal - Year 2016 Grand Forks AFB[b]	**0.003**	**0.001**	**0.001**	**0.000**	–	–	–	–	–	–

Table D.3-9. Annual Air Emissions for Existing AGE Usages – Grand Forks AFB KC-46A Scenarios (Continued)

Scenario/Source	Annual Emissions - Tons									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*
Year 2012 - Fairchild AFB										
10-50 Hp	–	–	0.00	0.01	0.00	–	–	–	–	–
76-100 Hp	–	–	0.00	0.00	0.00	–	–	–	–	–
101-175 Hp	–	–	0.00	0.18	0.00	–	–	–	–	–
176-300 Hp	–	–	0.00	0.00	0.00	–	–	–	–	–
Subtotal - Year 2012 Fairchild AFB	–	–	**0.00**	**0.19**	**0.00**	–	–	–	–	–
Subtotal - Year 2012 Grand Forks AFB[a]	–	–	**0.000**	**0.009**	**0.00**	–	–	–	–	–
Subtotal - Year 2016 Grand Forks AFB[b]	–	–	**0.000**	**0.007**	**0.00**	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propionald-ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetrachlor-oethene*
Year 2012 - Fairchild AFB										
10-50 Hp	0.00	0.00	0.00	–	–	0.00	–	–	0.00	0.00
76-100 Hp	0.00	0.00	0.00	–	–	0.00	–	–	0.00	0.00
101-175 Hp	0.00	0.01	0.00	–	–	0.02	–	–	0.00	0.01
176-300 Hp	0.00	0.00	0.00	–	–	0.00	–	–	0.00	0.00
Subtotal - Year 2012 Fairchild AFB	**0.00**	**0.01**	**0.00**	–	–	**0.02**	–	–	**0.00**	**0.013**
Subtotal - Year 2012 Grand Forks AFB[a]	**0.000**	**0.001**	**0.000**	–	–	**0.001**	–	–	**0.00**	**0.001**
Subtotal - Year 2016 Grand Forks AFB[b]	**0.000**	**0.000**	**0.000**	–	–	**0.001**	–	–	**0.00**	**0.000**

Scenario/Source	Annual Emissions - Tons						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2012 - Fairchild AFB							
10-50 Hp	–	–	–	–	–	–	–
76-100 Hp	–	–	–	–	–	–	–
101-175 Hp	–	–	–	–	–	–	–
176-300 Hp	–	–	–	–	–	–	–
Subtotal - Year 2012 Fairchild AFB	–	–	–	–	–	–	–
Subtotal - Year 2012 Grand Forks AFB[a]	–	–	–	–	–	–	–
Subtotal - Year 2016 Grand Forks AFB[b]	–	–	–	–	–	–	–

[a] 2012 Grand Forks AGE emissions = 5% of those for Fairchild.

[b] 2016 Grand Forks AGE emissions = 2012 Grand Forks AGE emissions * (2016 Grand Forks AGE nonroad Efs/2012 Fairchild nonroad EFs).

Key: – = Source does not emit particular pollutant, AFB = Air Force Base, AGE = aerospace ground equipment, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, Efs = emission factors, Hp = horsepower, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-10. Annual Emissions from GMV Activities – Grand Forks AFB KC-46A Scenarios

Scenario/Vehicle Class	Tons per Year									
	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Year 2012 Fairchild AFB										
Alternative-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
Diesel Vehicles	0.04	0.22	0.92	0.00	0.05	0.04	167.46	0.00	0.00	167
Gasoline Vehicles	0.01	0.52	0.09	0.00	0.00	0.00	48.09	0.00	0.00	48
Total	**0.05**	**0.74**	**1.01**	**0.00**	**0.05**	**0.04**	**215.55**	**0.00**	**0.00**	**215.59**
Year 2016 Fairchild AFB MOB 1										
Alternative-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
Diesel Vehicles	0.02	0.14	0.61	0.00	0.03	0.03	180.05	0.00	0.00	180
Gasoline Vehicles	0.01	0.49	0.08	0.00	0.00	0.00	47.63	0.00	0.00	48
Total	**0.03**	**0.64**	**0.69**	**0.00**	**0.04**	**0.03**	**227.67**	**0.00**	**0.00**	**227.71**
Year 2012 Grand Forks AFB										
Alternative-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
Diesel Vehicles	0.02	0.09	0.40	0.00	0.02	0.02	72.12	0.00	0.00	72.13
Gasoline Vehicles	0.01	0.22	0.04	0.00	0.00	0.00	20.71	0.00	0.00	20.72
Total	**0.02**	**0.32**	**0.43**	**0.00**	**0.02**	**0.02**	**92.83**	**0.00**	**0.00**	**92.85**
Year 2016 Grand Forks AFB MOB 1										
Alternative-Fueled Vehicles	–	–	–	–	–	–	–	–	–	–
Diesel Vehicles	0.02	0.10	0.42	0.00	0.02	0.02	122.27	0.00	0.00	122.29
Gasoline Vehicles	0.01	0.33	0.05	0.00	0.00	0.00	32.34	0.00	0.00	32.35
Total	**0.02**	**0.43**	**0.47**	**0.00**	**0.03**	**0.02**	**154.61**	**0.00**	**0.00**	**154.64**

Note: Grand Fork GMV emissions for 2012 and 2016 = Fairchild GMV emissions * Grand Fork scenario worker fraction of Fairchild for each year.

Key: – = Source does not emit particular pollutant, AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMV = government motor vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-11. Annual Number of Workers – Grand Forks/Fairchild AFB KC-46A Project Scenarios

Scenario	Total # of Workers
Year 2012 - Fairchild AFB	5,835
Year 2012 - Grand Forks AFB	2,513
Year 2016 - Fairchild AFB MOB 1	6,273
Year 2016 - Grand Forks AFB MOB 1	4,260

Key: AFB = Air Force Base, MOB 1 = First Main Operating Base.

Table D.3-12. Annual On Base On-Road Vehicle Mileage Calculations – Grand Forks AFB KC-46A Project Scenarios

Scenario	# of Workers	Vehicle Occupancy Rate	On-Base Miles per Round Trip[a]	On-Base Miles per Day	On-Base Miles per year[b]
Year 2012	2,513	0.95	6.00	14,324	3,724,266
Year 2016 MOB 1	4,260	0.95	6.00	24,282	6,313,320
MOB 1 Only	1,747	0.95	6.00	9,958	2,589,054

[a] Source: Grand Forks AFB

[b] Based on 260 days per year.

Key: AFB = Air Force Base, MOB 1 = First Main Operating Base.

Table D.3-13. Annual Average On-Road Emission Factors – Grand Forks AFB KC-46A Proposed Actions

Project Year/ Source Type	Emission Factors (Grams/Mile)[a]									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Year 2012										
LDGV - Road 3	0.06	2.43	0.43	0.00	0.02	0.01	321	0.00	0.00	321
HDDV - Road 3	0.42	2.51	10.27	0.01	0.56	0.50	1,949	0.00	0.00	1,949
Composite[b]	0.07	2.43	0.62	0.00	0.03	0.02	353.61	0.00	0.00	354
Year 2016 FTU										
LDGV - Road 3	0.03	1.82	0.21	0.00	0.02	0.01	302	0.00	0.00	302
HDDV - Road 3	0.25	1.57	6.75	0.01	0.36	0.30	1,949	0.00	0.00	1,949
Composite[b]	0.03	1.81	0.34	0.00	0.03	0.02	335.20	0.00	0.00	335

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Grand Forks County

[b] Equal to 98/2% LDGV/HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-14. Annual Emissions from On Base On-Road Vehicle Activities – Grand Forks AFB KC-46A Scenarios

Scenario Year/Source Type	Tons per Year									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Year 2012	0.28	9.96	2.56	0.02	0.14	0.09	1,451.66	0.00	0.00	1,451.82
Year 2016 MOB 1	0.24	12.63	2.38	0.03	0.20	0.12	2,332.71	0.00	0.00	2,333.07

Note: Assumes that 2% of the fleet is HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, HDDV = heavy duty diesel vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-15. Annual Off Base On-Road Vehicle Mileage Calculations – Grand Forks AFB KC-46A Project Scenarios

Scenario	# of Workers	Vehicle Occupancy Rate	Off Base Miles per 1-Way Trip[a]	Off Base Miles per Day	Off Base Miles per year[b]
Year 2012	2,513	0.95	20	95,494	24,828,440
Year 2016 MOB 1	4,260	0.95	20	161,880	42,088,800
MOB 1 Only	1,747	0.95	20	33,193	8,630,180

[a] Source: Grand Forks AFB

[b] Based on 260 days per year.

Key: # = number, AFB = Air Force Base, MOB 1 = First Main Operating Base.

Table D.3-16. Annual Average On-Road Emission Factors – Grand Forks AFB KC-46A Proposed Actions

Project Year/Source Type	Emission Factors (Grams/Mile)[a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV - Road 3	0.06	2.43	0.43	0.00	0.02	0.01	321	0.001	0.0001	321
LDGV - Road 5	0.09	3.12	0.45	0.01	0.04	0.02	397	0.001	0.0002	397
LDGV - Composite[b]	0.08	3.02	0.44	0.01	0.04	0.02	386	0.001	0.000	386
HDDV - Road 3	0.42	2.51	10.27	0.01	0.56	0.50	1,949	0.000	0.000	1,949
HDDV - Road 5	0.66	3.67	12.66	0.02	1.00	0.83	2,426	0.000	0.000	2,426
HDDV - Composite[b]	0.62	3.50	12.30	0.02	0.93	0.78	2,355	0.000	0.000	2,355
Year 2016 FTU										
LDGV - Road 3	0.03	1.82	0.21	0.00	0.02	0.01	302	0.001	0.0001	302
LDGV - Road 5	0.38	2.34	0.22	0.01	0.04	0.17	374	0.001	0.0002	374
LDGV - Composite[b]	0.29	2.21	0.21	0.01	0.03	0.13	356	0.001	0.000	356
HDDV - Road 3	0.25	1.57	6.75	0.01	0.36	0.30	1,949	0.000	0.000	1,949
HDDV - Road 5	0.40	2.29	8.39	0.02	0.67	0.51	2,427	0.000	0.000	2,427
HDDV - Composite[b]	0.37	2.11	7.98	0.02	0.59	0.46	2,307	0.000	0.000	2,307

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Jackson County

[b] Equal to 15/85% road 3/road 5 conditions.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-17. Annual Emissions from Off-Base Vehicle Activities – Grand Forks AFB KC-46A Scenarios

Scenario Year/Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV	2.19	80.88	11.93	0.15	1.01	0.48	10,352.20	0.02	0.00	10,353.94
HDDV	0.34	1.91	6.73	0.01	0.51	0.43	1,288.84	0.00	0.00	1,288.84
Total	**2.53**	**82.80**	**18.66**	**0.16**	**1.52**	**0.91**	**11,641.04**	**0.02**	**0.00**	**11,642.78**
Year 2016 MOB 1										
LDGV	13.30	100.34	9.74	0.24	1.54	5.85	16,175.90	0.03	0.01	16,178.63
HDDV	0.34	1.95	7.40	0.02	0.55	0.42	2,140.79	0.00	0.00	2,140.79
Total	**13.64**	**102.30**	**17.14**	**0.26**	**2.09**	**6.28**	**18,316.69**	**0.03**	**0.01**	**18,319.42**

Note: Assumes that 2% of the fleet is HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-18. Annual Mobile Fuel Transfer VOC Emissions – Grand Forks AFB KC-46A Scenarios

Scenario	Tons per Year									
	VOC	*Benzene*	*Cumene*	*Ethyl-benzene*	*Hexane*	*MTBE*	*Naphth-alene*	*Toluene*	2,2,4 Trimethyl-pentane	*Xylenes*
Year 2011 - Grand Forks AFB[b]	0.03	0.0002	0.0001	0.0001	0.0000	0.0002	0.0000	0.0004	0.0000	0.0006
Year 2012 - Grand Forks AFB	0.04	0.0002	0.0001	0.0001	0.0000	0.0002	0.0000	0.0004	0.0000	0.0006
Year 2016 MOB 1 - from Fairchild AFB	0.36	0.0025	0.0012	0.0010	0.0003	0.0020	0.0000	0.0045	0.0004	0.0068

[a] Future year emissions = 2011 emissions * future year fraction of 2011 worker population.

[b] Source: 2011 Actual and Potential Air Emissions Inventory for GFAFB (Sullivan-Weston Services JVA, LLC 2012)

Key: AFB = Air Force Base, MOB 1 = First Main Operating Base, VOC = volatile organic compound.

Table D.3-19. Annual Number of Workers – Grand Forks AFB KC-46A Project Scenarios

Scenario	# of Workers
Year 2011	2,275
Year 2012	2,513
Year 2016 MOB 1	4,260

Key: # = number, MOB 1 = First Main Operating Base.

Table D.3-20. Annual Emissions from Point and Area Sources – Grand Forks AFB KC-46A Scenarios

Scenario Year/Source Type	Tons per Year						
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*
Year 2011[a]	20.27	11.40	15.00	0.09	7.20	1.20	–
Year 2012	22.39	12.59	16.57	0.10	7.95	1.33	–
Year 2016 MOB 1	37.95	21.35	28.09	0.17	13.48	2.25	–

Scenario Year/Source Type	Tons per Year									
	Acetalde-hyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloroform*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Year 2011[a]	0.000	–	0.083	–	0.002	–	–	–	–	–
Year 2012	0.000	–	0.092	–	0.002	–	–	–	–	–
Year 2016 MOB 1	0.000	–	0.155	–	0.003	–	–	–	–	–

Scenario Year/Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*Hexane*	*Methanol*	*Methylene Chloride*	*MIBK*	*MTBE*
Year 2011[a]	0.003	–	–	–	–	0.316	0.001	0.052	0.009	0.312
Year 2012	0.003	–	–	–	–	0.349	0.001	0.057	0.009	0.344
Year 2016 MOB 1	0.006	–	–	–	–	0.592	0.001	0.096	0.016	0.583

Scenario Year/Source Type	Tons per Year										
	Naphth-alene	*Phenol*	*POM*	*Propionald-ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetrachlor-oethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*o-Xylene*
Year 2011[a]	0.037	–	0.000	–	0.000	0.008	–	0.739	–	–	0.104
Year 2012	0.041	–	0.000	–	0.000	0.009	–	0.816	–	–	0.114
Year 2016 MOB 1	0.069	–	0.000	–	0.000	0.015	–	1.384	–	–	0.194

[a] Source: 2011 Actual and Potential Air Emissions Inventory for GFAFB (Sullivan-Weston Services JVA, LLC 2012). Excludes fuel transfer VOCs, as these accounted for in separate section.

Key: – = Source does not emit particular pollutant, CO = carbon monoxide, CO_2 = carbon dioxide, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.3-21. Annual Emissions for Existing Operations at Grand Forks AFB – Year 2012

Source Type	Tons per Year									
	VOC	***CO***	***NOX***	***SO2***	***PM10***	***PM2.5***	***CO2***	***CH4***	***N2O***	***CO2e (mt)***
UAS Operations	0.56	2.48	12.73	1.04	0.23	0.23	3,169	0.09	0.10	2,910
Transient Aircraft Operations	0.52	1.90	1.18	0.12	0.29	0.29	217	0.01	0.01	199
On-Wing Aircraft Engine Testing - UASs	0.17	0.71	0.80	0.10	0.02	0.02	285	0.01	0.01	262
Aerospace Ground Support Equipment	0.06	0.44	0.52	0.01	0.07	0.06	69	0.01	0.00	63
GMVs/Nonroad Equipment	0.02	0.32	0.43	0.00	0.02	0.02	93	0.00	0.00	84
Privately-Owned Vehicles - On-Base	0.28	9.96	2.56	0.02	0.14	0.09	1,452	0.00	0.00	1,320
Privately-Owned Vehicles - Off-Base	2.53	82.80	18.66	0.16	1.52	0.91	11,641	0.02	0.00	10,584
Mobile Fuel Transfer Operations	0.04	–	–	–	–	–	–	–	–	–
Point and Area Sources	22.39	12.59	16.57	0.10	7.95	1.33	–	–	–	–
Total Emissions	**37.47**	**111.21**	**53.46**	**1.56**	**10.24**	**2.95**	**16,926**	**0.14**	**0.12**	**15,423**

Source Type	Tons per Year									
	Acetal-dehyde	***Acrolein***	***Benzene***	***1,3-Butadiene***	***Carbon Disulfide***	***Carbon Tetra-chloride***	***Chloro-form***	***Chloro-methane***	***o-Cresol***	***p-Cresol***
UAS Operations	0.024	0.014	0.010	0.010	–	–	–	–	–	–
Transient Aircraft Operations	0.001	0.001	0.002	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UASs	0.011	0.006	0.004	0.004	–	–	–	–	–	–
Aerospace Ground Support Equipment	0.005	0.001	0.001	0.000	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.000	–	–	–	–	–	–	–
Point and Area Sources	0.000	0.000	0.092	–	0.002	–	–	–	–	–
Total Emissions	**0.041**	**0.022**	**0.109**	**0.014**	**0.002**	–	–	–	–	–

Source Type	Tons per Year									
	Cumene	***Dibenzo-furan***	***Dibutyl Phthalate***	***1,2-Dichloro-propane***	***2,4-Dinitro-phenol***	***DEHP***	***Ethyl-benzene***	***Formald-ehyde***	***Hexane***	***Methanol***
UAS Operations	–	–	–	–	–	–	0.001	0.070	–	0.010
Transient Aircraft Operations	–	–	–	–	–	–	0.000	0.008	–	–
On-Wing Aircraft Engine Testing - UASs	–	–	–	–	–	–	0.000	0.030	–	0.004
Aerospace Ground Support Equipment	–	–	0.000	0.009	0.000	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.00	–	–	–	–	–	0.00	–	0.00	–
Point and Area Sources	0.003	–	–	–	–	–	0.032	0.012	0.349	0.001
Total Emissions	**0.003**	–	**0.000**	**0.009**	**0.000**	–	**0.034**	**0.120**	**0.349**	**0.015**

Table D.3-21. Annual Emissions for Existing Operations at Grand Forks AFB – Year 2012 (Continued)

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naph-thalene*	*Phenol*	*POM*	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*
UAS Operations	–	–	–	0.003	0.004	–	0.004	0.002	–	–
Transient Aircraft Operations	–	–	–	0.001	–	–	–	0.000	–	–
On-Wing Aircraft Engine Testing - UASs	–	–	–	0.001	0.002	–	0.002	0.001	–	–
Aerospace Ground Support Equipment	0.000	0.001	0.000	–	–	0.001	–	–	–	0.001
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.00	0.00	–	–	–	–	–	–
Point and Area Sources	0.057	0.009	0.344	0.041	–	0.000	–	0.000	0.009	–
Total Emissions	**0.057**	**0.010**	**0.344**	**0.046**	**0.006**	**0.001**	**0.006**	**0.003**	**0.009**	**0.001**

Source Type	Tons per Year						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
UAS Operations	0.003	–	–	–	–	0.002	0.001
Transient Aircraft Operations	0.001	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UASs	0.001	–	–	–	–	0.001	0.000
Aerospace Ground Support Equipment	–	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	0.00	–	0.00	–	–	0.00
Point and Area Sources	0.816	–	–	0.060	–	–	0.114
Total Emissions	**0.822**	**0.000**	–	**0.060**	–	**0.002**	**0.117**

Key: – = Source does not emit particular pollutant, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMV = government motor vehicle, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, UAS = Unmanned Aircraft System, VOC = volatile organic compound.

Table D.3-22. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Grand Forks AFB – Year 2016

Source Type	Tons per Year									
	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e (mt)
KC-46A Aircraft Operations	50.07	201.74	837.57	45.42	2.92	2.49	136,814	3.79	4.25	125,648
On-Wing Aircraft Engine Testing - KC-46A	14.39	49.54	28.94	2.34	0.21	0.19	6,844	0.19	0.21	6,286
Aerospace Ground Support Equipment - KC-46A	0.59	4.22	4.80	0.18	0.71	0.65	937.05	0.14	0.01	857.54
UAS Operations	0.56	2.48	12.73	1.04	0.23	0.23	3,169	0.09	0.10	2,910
Transient Aircraft	0.52	1.90	1.18	0.12	0.29	0.29	217	0.01	0.01	199
On-Wing Aircraft Engine Testing - UASs	0.17	0.71	0.80	0.10	0.02	0.02	285	0.01	0.01	262
AGE - Existing Aircraft	0.04	0.31	0.35	0.01	0.05	0.05	69	0.01	0.00	63
Government Motor Vehicles	0.02	0.43	0.47	0.00	0.03	0.02	155	0.00	0.00	141
Privately-Owned Vehicles - On-Base	0.24	12.63	2.38	0.03	0.20	0.12	2,333	0.00	0.00	2,121
Privately-Owned Vehicles - Off-Base	13.64	102.30	17.14	0.26	2.09	6.28	18,317	0.03	0.01	16,654
Mobile Fuel Transfer Operations	0.36	–	–	–	–	–	–	–	–	–
Point and Area Sources	37.95	21.35	28.09	0.17	13.48	2.25	–	–	–	–
Total Proposed Emissions - 2016	**118.55**	**397.60**	**934.45**	**49.67**	**20.21**	**12.58**	**169,140**	**4.27**	**4.60**	**155,141**
Year 2012 Base Case Emissions	**(37.47)**	**(111.21)**	**(53.46)**	**(1.56)**	**(10.24)**	**(2.95)**	**(16,926)**	**(0.14)**	**(0.12)**	**(15,423)**
Proposed Year 2016 minus Base Case Emissions	**81.08**	**286.39**	**880.99**	**48.12**	**9.98**	**9.63**	**152,214**	**4.13**	**4.48**	**139,718**
PSD Thresholds	**250**	**250**	**250**	**250**	**250**	**250**				
Fractional Increase from Existing Conditions	**2.16**	**2.58**	**16.48**	**30.89**	**0.97**	**3.27**				**9.06**
Grand Forks County 2008 Emissions	**8,202**	**14,242**	**4,054**	**684**	**14,670**	**2,788**				**479,163**
Fractional Increase from Grand Forks County Emissions	**0.01**	**0.02**	**0.22**	**0.07**	**0.001**	**0.003**				**0.29**

Source Type	Tons per Year									
	Acetalde-hyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloroform	Chloro-methane	o-Cresol	p-Cresol
KC-46A Aircraft Operations	2.157	1.237	0.849	0.852	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-46A	0.620	0.356	0.244	0.245	-	-	-	-	-	-
Aerospace Ground Support Equipment - KC-46A	0.044	0.007	0.012	0.001	–	–	–	–	–	–
UAS Operations	0.024	0.014	0.010	0.010	–	–	–	–	–	–
Transient Aircraft	0.001	0.001	0.002	-	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UASs	0.011	0.006	0.004	0.004	–	–	–	–	–	–
AGE - Existing Aircraft	0.003	0.000	0.001	0.000	–	–	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.00	–	–	–	–	–	–	–
Point and Area Sources	0.00	-	0.16	–	0.00	–	–	–	–	–
Total Proposed Emissions - 2016	**2.861**	**1.621**	**1.280**	**1.112**	**0.003**	**-**	**-**	**-**	**-**	**-**
Year 2012 Base Case Emissions	**(0.041)**	**(0.022)**	**(0.109)**	**(0.014)**	**(0.002)**	**-**	**-**	**-**	**-**	**-**
Proposed Year 2016 minus Base Case Emissions	**2.820**	**1.599**	**1.171**	**1.098**	**0.001**	**-**	**-**	**-**	**-**	**-**
PSD Thresholds										
Fractional Increase from Existing Conditions	**68.78**	**73.94**	**10.72**	**78.78**	**0.70**					
Grand Forks County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Grand Forks County Emissions	–	–	–	–	–	–	–	–	–	–

Table D.3-22. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Grand Forks AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*
KC-46A Aircraft Operations	–	–	–	–	–	–	0.088	6.216	–	0.912
On-Wing Aircraft Engine Testing - KC-46A	-	-	-	-	-	-	0.025	1.787	-	0.262
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	–	0.002	0.088	0.001	–
UAS Operations	–	–	–	–	–	–	0.001	0.070	–	0.010
Transient Aircraft	–	–	–	–	–	–	0.000	0.008	–	–
On-Wing Aircraft Engine Testing - UASs	–	–	–	–	–	–	0.000	0.030	–	0.004
AGE - Existing Aircraft	–	–	0.000	0.006	0.000	–	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.00	–	–	–	–	–	0.00	–	0.00	–
Point and Area Sources	0.01	–	–	–	–	–	0.05	0.02	0.59	0.00
Total Proposed Emissions - 2016	**0.007**	**-**	**0.000**	**0.006**	**0.000**	**-**	**0.173**	**8.219**	**0.593**	**1.189**
Year 2012 Base Case Emissions	**(0.003)**	**-**	**(0.000)**	**(0.009)**	**(0.000)**	**-**	**(0.034)**	**(0.120)**	**(0.349)**	**(0.015)**
Proposed Year 2016 minus Base Case Emissions	**0.003**	**-**	**(0.000)**	**(0.003)**	**(0.000)**	**-**	**0.139**	**8.099**	**0.244**	**1.174**
PSD Thresholds										
Fractional Increase from Existing Conditions	**0.99**		**(0.36)**	**(0.36)**	**(0.36)**		**4.04**	**67.54**	**0.70**	**77.04**
Grand Forks County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Grand Forks County Emissions	–	–	–	–	–	–	–	–	–	–

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propionald-ehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetrachlor-oethene*
KC-46A Aircraft Operations	–	–	–	0.273	0.367	–	–	0.156	–	–
On-Wing Aircraft Engine Testing - KC-46A	-	-	-	0.079	0.105	-	-	0.045	-	-
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	0.000	0.006	0.000	–	–
UAS Operations	–	–	–	0.003	0.004	–	0.004	0.002	–	–
Transient Aircraft	–	–	–	0.001	–	–	–	0.000	–	–
On-Wing Aircraft Engine Testing - UASs	–	–	–	0.001	0.002	–	0.002	0.001	–	–
AGE - Existing Aircraft	0.000	0.000	0.000	–	–	0.001	–	–	–	0.000
Government Motor Vehicles	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.00	0.00	–	–	–	–	–	–
Point and Area Sources	0.10	0.02	0.58	0.07	–	0.00	–	0.00	0.01	–
Total Proposed Emissions - 2016	**0.096**	**0.016**	**0.585**	**0.426**	**0.478**	**0.001**	**0.011**	**0.204**	**0.015**	**0.000**
Year 2012 Base Case Emissions	**(0.057)**	**(0.010)**	**(0.344)**	**(0.046)**	**(0.006)**	**(0.001)**	**(0.006)**	**(0.003)**	**(0.009)**	**(0.001)**
Proposed Year 2016 minus Base Case Emissions	**0.040**	**0.006**	**0.241**	**0.380**	**0.472**	**(0.000)**	**0.006**	**0.202**	**0.006**	**(0.000)**
PSD Thresholds										
Fractional Increase from Existing Conditions	**0.70**	**0.63**	**0.70**	**8.34**	**82.97**	**(0.30)**	**1.02**	**71.29**	**0.70**	**(0.36)**
Grand Forks County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Grand Forks County Emissions	–	–	–	–	–	–	–	–	–	–

Table D.3-22. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at Grand Forks AFB – Year 2016 (Continued)

Source Type	Tons per Year						
	Toluene	**1,1,1-Trichloro-ethane**	**Trichloro-ethene**	**2,2,4-Trimethyl-pentane**	**Vinyl Acetate**	**mp-Xylene**	**o-Xylene**
KC-46A Aircraft Operations	0.324	–	–	–	–	0.143	0.084
On-Wing Aircraft Engine Testing - KC-46A	0.093	-	-	-	-	0.041	0.024
Aerospace Ground Support Equipment - KC-46A	0.009	–	–	–	–	–	0.006
UAS Operations	0.003	–	–	–	–	0.002	0.001
Transient Aircraft	0.001	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - UASs	0.001	–	–	–	–	0.001	0.000
AGE - Existing Aircraft	–	–	–	–	–	–	–
Government Motor Vehicles	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	0.00	–	0.00	–	–	0.01
Point and Area Sources	1.38	–	–	0.10	–	–	0.19
Total Proposed Emissions - 2016	**1.816**	**0.004**	**-**	**0.102**	**-**	**0.186**	**0.316**
Year 2012 Base Case Emissions	**(0.822)**	**(0.000)**	**-**	**(0.060)**	**-**	**(0.002)**	**(0.117)**
Proposed Year 2016 minus Base Case Emissions	**0.994**	**0.004**	**-**	**0.042**	**-**	**0.183**	**0.200**
PSD Thresholds							
Fractional Increase from Existing Conditions	**1.21**	**9.80**		**0.70**		**75.23**	**1.71**
Grand Forks County 2008 Emissions	–	–	–	–	–	–	–
Fractional Increase from Grand Forks County Emissions	–	–	–	–	–	–	–

Key: ( ) = parenthesis indicate negative numbers, – = Source does not emit particular pollutant, AGE = aerospace ground equipment, CH_4 = methane, Co = county, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, UAS = Unmanned Aircraft System, VOC = volatile organic compound.

D.4 McCONNELL AIR FORCE BASE REGIONAL CLIMATE

McConnell, Kansas, has a continental climate, characterized by pronounced variations in daily and seasonal temperatures and seasonal and annual precipitation. Meteorological data collected at Wichita Mid-Continent Airport are used to describe the climate of the McConnell AFB project area (NOAA 1998, 2013b).

Temperature. The McConnell AFB project region is known for high temperatures in the summer months and cool conditions during the winter. The average high and low temperatures during the summer months for the region range from about 92 degrees Fahrenheit (°F) to 60 °F. The average high and low temperatures during the winter months range from 58 °F to 22 °F.

Precipitation. The average annual precipitation for McConnell AFB is 32.6 inches. Precipitation is greatest during the warmer months of the year, and the peak monthly average of 5.1 inches occurs in June. Precipitation is at a minimum during the winter, as the lowest monthly average of 0.9 inches occurs in January. Snow is not uncommon during winter; the average annual snowfall amounts to 15.5 inches.

Prevailing Winds. McConnell AFB experiences fairly breezy conditions, as the average wind speed for each month of the year is at least 8 miles per hour and the annual average wind speed is 9.6 miles per hour. Spring is generally the windiest season, as the peak average monthly winds of 11 miles per hour occur in March and April. The winds prevail from the north from January through August and from the south from September through December (NOAA 1998).

D.4.1 OPERATIONS EMISSION CALCULATIONS FOR THE KC-46A PROJECT SCENARIOS AT McCONNELL AFB

Table D.4-1. Annual Air Operations for Aircraft at Fairchild AFB – Year 2012

Aircraft	Number of Operations				
	LTO	TGO	LFB	LFP	Total
KC-135	1,474	–	–	5,983	**7,457**
UH-60	1,302	–	–	720	**2,022**
UH-1N	412	–	–	2,184	**2,596**
Transient	975	–	–	2,205	**3,179**
Totals	**4,162**	–	–	**11,091**	**15,253**

Key: LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.

Table D.4-2. Annual Air Operations for Aircraft at McConnell AFB – Year 2012

Aircraft	Number of Operations				
	LTO	TGO	LFB	LFP	Total
KC-135	2,771	–	–	9,490	**12,261**
Transient	2,838	–	–	2,838	**5,676**
Totals	**5,609**	–	–	**12,328**	**17,937**

Key: LFB = low flyby, LFP = low flight pattern, LTO = landing and takeoff, TGO = touch and go.
Source: EIS Table 2-17.

Table D.4-3. Year 2012 Aircraft Closed Pattern Operations at McConnell AFB – KC-46A Project Existing Conditions

Aircraft Type/Operation	Operations per Year	Engine Setting/Time in Mode (Minutes)				Engine Setting Annual Hours			
		55%	60%	Climbout	Takeoff	55%	60%	Climbout	Takeoff
KC-135									
Closed Pattern - Radar & Initial to Overhead	4,413	12.0	2.0	–	1.0	883	147	–	74
Closed Pattern - VFR	2,998	5.0	2.0	–	1.0	250	100	–	50
Closed Pattern - Tactical	2,079	8.0	2.0	2.0	1.0	277	69	69	35
Total TIMs -						**1,410**	**316**	**69**	**158**
Transient [a]									
Closed Pattern - Radar & Initial to Overhead	1,320	12.0	2.0	–	1.0	264	44	–	22
Closed Pattern - VFR	896	5.0	2.0	–	1.0	75	30	–	15
Closed Pattern - Tactical	622	8.0	2.0	2.0	1.0	83	21	21	10
Total TIMs -						**422**	**95**	**21**	**47**

[a] Engine setting TIMs assumed = KC-135 as there are several large aircraft = KC-135s and C-130s.
Key: % = percent, TIM = Time in Mode, VFR = visual flight rules.

Table D.4-4. Annual Air Emissions from Year 2012 Aircraft Operations at McConnell AFB – KC-46A Project Existing Conditions

Scenario/Source	Annual Emissions - Tons									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Fairchild AFB - Year 2012										
Transient Aircraft - LTOs	3.95	14.49	9.00	0.90	2.20	2.20	1,649.33	0.05	0.05	1,666.19
Transient Aircraft - Closed Patterns	0.30	7.97	55.49	4.53	0.24	0.24	13,756.55	0.38	0.43	13,897.15
McConnell AFB Year 2012 - LTOs										
KC-135 Aircraft	9.59	142.20	52.23	7.54	0.42	0.42	22,870	0.63	0.71	23,104
Transient Aircraft	11.50	42.21	26.20	2.62	6.40	6.40	4,803	0.13	0.15	4,852
Subtotal - McConnell AFB Year 2012 LTOs	**21.08**	**184.40**	**78.42**	**10.16**	**6.83**	**6.83**	**27,673**	**0.77**	**0.86**	**27,956**
McConnell AFB Year 2012 - Closed Patterns										
KC-135 - 55%	0.92	28.22	142.12	12.83	0.67	0.67	38,914	1.08	1.21	39,312
KC-135 - 60%	0.22	5.77	36.70	3.12	0.16	0.16	9,477	0.26	0.29	9,574
KC-135 - Climbout	0.05	0.08	14.39	0.95	0.04	0.04	2,892	0.08	0.09	2,921
KC-135 - Take-off	0.11	0.22	45.65	2.62	0.17	0.17	7,936	0.22	0.25	8,017
Transient Aircraft	0.39	10.25	71.43	5.84	0.31	0.31	17,710	0.49	0.55	17,891
Subtotal - McConnell AFB Year 2012 Closed Patterns	**1.69**	**44.54**	**310.30**	**25.36**	**1.36**	**1.36**	**76,929**	**2.13**	**2.39**	**77,715**
Total Year 2012 - McConnell AFB	**22.78**	**228.95**	**388.72**	**35.51**	**8.19**	**8.19**	**104,602**	**2.89**	**3.25**	**105,672**
Total Year 2012 KC-135 Aircraft Operations	**10.89**	**176.49**	**291.09**	**27.06**	**1.47**	**1.47**	**82,089**	**2.27**	**2.55**	**82,928**
Total Year 2012 Transient Aircraft Operations	**11.89**	**52.46**	**97.63**	**8.46**	**6.72**	**6.72**	**22,513**	**0.62**	**0.70**	**22,743**

Scenario/Source	Annual Emissions - Tons									
	Acetal-dehyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	o-Cresol	p-Cresol
Fairchild AFB - Year 2012										
Transient Aircraft - LTOs	0.01	0.01	0.02	–	–	–	–	–	–	–
Transient Aircraft - Closed Patterns	0.00	0.00	0.00	–	–	–	–	–	–	–
McConnell AFB Year 2012 - LTOs										
KC-135 Aircraft	–	–	0.01	–	–	0.00	0.01	0.01	–	–
Transient Aircraft	0.03	0.03	0.05	–	–	–	–	–	–	–
Subtotal - McConnell AFB Year 2012 LTOs	**0.03**	**0.03**	**0.06**	**–**	**–**	**0.00**	**0.01**	**0.01**	**–**	**–**
McConnell AFB Year 2012 - Closed Patterns										
KC-135 - 55%	–	–	0.02	–	–	0.01	0.02	0.01	–	–
KC-135 - 60%	–	–	0.00	–	–	0.00	0.01	0.00	–	–
KC-135 - Climbout	–	–	0.00	–	–	0.00	0.00	0.00	–	–
KC-135 - Take-off	–	–	0.00	–	–	–	0.00	0.00	–	–
Transient Aircraft	0.00	0.00	0.00	–	–	–	–	–	–	–
Subtotal - McConnell AFB Year 2012 Closed Patterns	**0.00**	**0.00**	**0.03**	**–**	**–**	**0.01**	**0.03**	**0.01**	**–**	**–**
Total Year 2012 - McConnell AFB	**0.03**	**0.03**	**0.10**	**–**	**–**	**0.01**	**0.05**	**0.02**	**–**	**–**
Total Year 2012 KC-135 Aircraft Operations	**–**	**–**	**0.04**	**–**	**–**	**0.01**	**0.05**	**0.02**	**–**	**–**
Total Year 2012 Transient Aircraft Operations	**0.03**	**0.03**	**0.05**	**–**	**–**	**–**	**–**	**–**	**–**	**–**

Table D.4-4. Annual Air Emissions from Year 2012 Aircraft Operations at McConnell AFB – KC-46A Project Existing Conditions (Continued)

Scenario/Source	Annual Emissions - Tons									
	Dibenzo-furan	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*Di(2-Ethyl-hexyl) Phthalate (DEHP)*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*	*Methylene Chloride*
Fairchild AFB - Year 2012										
Transient Aircraft - LTOs	–	–	–	–	–	0.00	0.06	–	–	–
Transient Aircraft - Closed Patterns	–	–	–	–	–	0.00	0.00	–	–	–
McConnell AFB Year 2012 - LTOs										
KC-135 Aircraft	–	–	–	–	0.03	0.00	0.45	–	–	0.40
Transient Aircraft	–	–	–	–	–	0.01	0.17	–	–	–
Subtotal - McConnell AFB Year 2012 LTOs	–	–	–	–	**0.03**	**0.01**	**0.63**	–	–	**0.40**
McConnell AFB Year 2012 - Closed Patterns										
KC-135 - 55%	–	–	–	–	0.03	0.00	0.13	–	–	0.57
KC-135 - 60%	–	–	–	–	0.01	0.00	0.03	–	–	0.14
KC-135 - Climbout	–	–	–	–	0.00	–	0.01	–	–	0.05
KC-135 - Take-off	–	–	–	–	0.00	–	0.02	–	–	0.00
Transient Aircraft	–	–	–	–	–	0.00	0.01	–	–	–
Subtotal - McConnell AFB Year 2012 Closed Patterns	–	–	–	–	**0.05**	**0.00**	**0.19**	–	–	**0.76**
Total Year 2012 - McConnell AFB	–	–	–	–	**0.08**	**0.01**	**0.81**	–	–	**1.17**
Total Year 2012 KC-135 Aircraft Operations	–	–	–	–	**0.08**	**0.01**	**0.63**	–	–	**1.17**
Total Year 2012 Transient Aircraft Operations	–	–	–	–	–	**0.01**	**0.18**	–	–	–

Scenario/Source	Annual Emissions - Tons									
	MIBK	*MTBE*	*Naph-thalene*	*Phenol*	*POM*	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetrachloroethane*	*Tetra-chloro-ethene*	*Toluene*
Fairchild AFB - Year 2012										
Transient Aircraft - LTOs	–	–	0.01	–	–	–	0.00	–	–	0.01
Transient Aircraft - Closed Patterns	–	–	0.00	–	–	–	0.00	–	–	0.00
McConnell AFB Year 2012 - LTOs										
KC-135 Aircraft	–	–	0.01	–	–	–	0.01	–	0.01	0.05
Transient Aircraft	–	–	0.01	–	–	–	0.01	–	–	0.02
Subtotal - McConnell AFB Year 2012 LTOs	–	–	**0.03**	–	–	–	**0.01**	–	**0.01**	**0.07**
McConnell AFB Year 2012 - Closed Patterns										
KC-135 - 55%	–	–	–	–	–	–	–	–	0.02	0.05
KC-135 - 60%	–	–	–	–	–	–	–	–	0.00	0.01
KC-135 - Climbout	–	–	–	–	–	–	–	–	0.00	0.00
KC-135 - Take-off	–	–	–	–	–	–	–	–	0.00	0.00
Transient Aircraft	–	–	0.00	–	–	–	0.00	–	–	0.00
Subtotal - McConnell AFB Year 2012 Closed Patterns	–	–	**0.00**	–	–	–	**0.00**	–	**0.03**	**0.06**
Total Year 2012 - McConnell AFB	–	–	**0.03**	–	–	–	**0.01**	–	**0.04**	**0.14**
Total Year 2012 KC-135 Aircraft Operations	–	–	**0.01**	–	–	–	**0.01**	–	**0.04**	**0.11**
Total Year 2012 Transient Aircraft Operations	–	–	**0.02**	–	–	–	**0.01**	–	–	**0.02**

Table D.4-4. Annual Air Emissions from Year 2012 Aircraft Operations at McConnell AFB – KC-46A Project Existing Conditions (Continued)

Scenario/Source	Annual Emissions - Tons				
	1,1,1-Trichloro-ethane	Trichloro-ethEne	Vinyl Acetate	mp-Xylene	o-Xylene
Fairchild AFB - Year 2012					
Transient Aircraft - LTOs	–	–	–	–	–
Transient Aircraft - Closed Patterns	–	–	–	–	–
McConnell AFB Year 2012 - LTOs					
KC-135 Aircraft	0.00	–	0.03	0.01	–
Transient Aircraft	–	–	–	–	–
Subtotal - McConnell AFB Year 2012 LTOs	**0.00**	–	**0.03**	**0.01**	–
McConnell AFB Year 2012 - Closed Patterns					
KC-135 - 55%	0.01	–	0.04	0.01	–
KC-135 - 60%	0.00	–	0.01	0.00	–
KC-135 - Climbout	–	–	0.00	0.00	–
KC-135 - Take-off	0.00	–	0.01	0.00	–
Transient Aircraft	–	–	–	–	–
Subtotal - McConnell AFB Year 2012 Closed Patterns	**0.01**	–	**0.06**	**0.02**	–
Total Year 2012 - McConnell AFB	**0.01**	–	**0.09**	**0.03**	–
Total Year 2012 KC-135 Aircraft Operations	**0.01**	–	**0.09**	**0.03**	–
Total Year 2012 Transient Aircraft Operations	–	–	–	–	–

Key: AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, LTO = landing and takeoff, McConnell AFB = McConnell Air Force Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-5. Annual Average Nonroad Emission Factors – Fairchild AFB and McConnell AFB

HP Category/Fuel Type	Emission Factors (Grams/Horsepower)[a]						
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Year 2012 - Fairchild AFB							
Nonroad Equipment - 25-40 Hp	0.70	3.43	4.87	0.13	0.50	0.46	609
Nonroad Equipment - 41-50 Hp	0.50	2.56	4.93	0.13	0.45	0.41	610
Nonroad Equipment - 51-75 Hp	0.48	2.52	4.90	0.13	0.44	0.40	611
Nonroad Equipment - 76-100 Hp	0.52	3.68	4.61	0.13	0.53	0.49	607
Nonroad Equipment - 101-175 Hp	0.54	3.92	4.58	0.13	0.61	0.56	608
Nonroad Equipment - 176-300 Hp	0.38	1.72	4.09	0.11	0.38	0.35	547
Year 2016 McConnell AFB							
Nonroad Equipment - 101-175 Hp	0.38	2.75	3.11	0.12	0.46	0.42	608

[a] Factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Spokane County 2012 and Sedgwick County 2016.

Key: AFB = Air Force Base, CO = carbon monoxide, CO_2 = carbon dioxide, EPA = Environmental Protection Agency, Hp = horsepower, NO_x = nitrogen oxides, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-6. Annual Air Emissions for Existing AGE Usages – McConnell AFB KC-46A Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 - Fairchild AFB										
10-50 Hp	0.04	0.17	0.24	0.01	0.03	0.02	30	0.00	0.00	30.68
76-100 Hp	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.26
101-175 Hp	1.20	8.70	10.17	0.29	1.35	1.25	1,350	0.21	0.01	1,358.71
176-300 Hp	0.00	0.02	0.04	0.00	0.00	0.00	5	0.00	0.00	4.95
Subtotal - Year 2012 Fairchild AFB	**1.24**	**8.89**	**10.45**	**0.30**	**1.38**	**1.27**	**1,385**	**0.21**	**0.02**	**1,395**
Subtotal - Year 2012 McConnell AFB [a]	**1.67**	**11.98**	**14.08**	**0.40**	**1.86**	**1.71**	**1,867**	**0.29**	**0.02**	**1,879**
Subtotal - Year 2016 McConnell AFB FTU Scenario [b]	**1.17**	**8.41**	**9.56**	**0.37**	**1.41**	**1.29**	**1,868**	**0.29**	**0.02**	**1,881**
Subtotal - Year 2016 McConnell AFB MOB 1 Scenario[c]	**0.59**	**4.25**	**4.84**	**0.19**	**0.71**	**0.65**	**945**	**0.15**	**0.01**	**952**

Scenario/Source	Annual Emissions - Tons									
	Acetal-dehyde	*Acrolein*	*Benzene*	*1,3-Buta-diene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Year 2012 - Fairchild AFB										
10-50 Hp	0.00	0.00	0.00	0.00	–	–	–	–	–	–
76-100 Hp	0.00	0.00	0.00	0.00	–	–	–	–	–	–
101-175 Hp	0.09	0.01	0.02	0.00	–	–	–	–	–	–
176-300 Hp	0.00	0.00	0.00	0.00	–	–	–	–	–	–
Subtotal - Year 2012 Fairchild AFB	**0.09**	**0.01**	**0.03**	**0.00**	–	–	–	–	–	–
Subtotal - Year 2012 McConnell AFB [a]	**0.12**	**0.02**	**0.03**	**0.00**	–	–	–	–	–	–
Subtotal - Year 2016 McConnell AFB FTU Scenario [b]	**0.09**	**0.01**	**0.02**	**0.00**	–	–	–	–	–	–
Subtotal - Year 2016 McConnell AFB MOB 1 Scenario[c]	**0.06**	**0.01**	**0.02**	**0.00**	–	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	Dibenzo-furan	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*Di(2-Ethylhexyl) Phthalate (DEHP)*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*	*Methylene Chloride*
Year 2012 - Fairchild AFB										
10-50 Hp	–	–	0.00	0.01	0.00	–	–	–	–	–
76-100 Hp	–	–	0.00	0.00	0.00	–	–	–	–	–
101-175 Hp	–	–	0.00	0.18	0.00	–	–	–	–	–
176-300 Hp	–	–	0.00	0.00	0.00	–	–	–	–	–
Subtotal - Year 2012 Fairchild AFB	–	–	**0.00**	**0.19**	**0.00**	–	–	–	–	–
Subtotal - Year 2012 McConnell AFB [a]	–	–	**0.01**	**0.25**	**0.00**	–	–	–	–	–
Subtotal - Year 2016 McConnell AFB FTU Scenario [b]	–	–	**0.00**	**0.18**	**0.00**	–	–	–	–	–
Subtotal - Year 2016 McConnell AFB MOB 1 Scenario[c]	–	–	**0.00**	**0.12**	**0.00**	–	–	–	–	–

Table D.4-6. Annual Air Emissions for Existing AGE Usages – McConnell AFB KC-46A Scenarios (Continued)

Scenario/Source	Annual Emissions - Tons									
	MIBK	*MTBE*	*Naph-thalene*	*Phenol*	*POM*	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*
Year 2012 - Fairchild AFB										
10-50 Hp	0.00	0.00	0.00	–	–	0.00	–	–	–	0.00
76-100 Hp	0.00	0.00	0.00	–	–	0.00	–	–	–	0.00
101-175 Hp	0.00	0.01	0.00	–	–	0.02	–	–	–	0.01
176-300 Hp	0.00	0.00	0.00	–	–	0.00	–	–	–	0.00
Subtotal - Year 2012 Fairchild AFB	**0.00**	**0.01**	**0.00**	–	–	**0.02**	–	–	–	**0.01**
Subtotal - Year 2012 McConnell AFB [a]	**0.00**	**0.02**	**0.00**	–	–	**0.03**	–	–	–	**0.02**
Subtotal - Year 2016 McConnell AFB FTU Scenario [b]	**0.00**	**0.01**	**0.00**	–	–	**0.02**	–	–	–	**0.01**
Subtotal - Year 2016 McConnell AFB MOB 1 Scenario[c]	**0.00**	**0.01**	**0.00**	–	–	**0.01**	–	–	–	**0.01**

Scenario/Source	Annual Emissions - Tons				
	1,1,1-Trichloro-ethane	*Trichloro-ethEne*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2012 - Fairchild AFB					
10-50 Hp	–	–	–	–	–
76-100 Hp	–	–	–	–	–
101-175 Hp	–	–	–	–	–
176-300 Hp	–	–	–	–	–
Subtotal - Year 2012 Fairchild AFB	–	–	–	–	–
Subtotal - Year 2012 McConnell AFB [a]	–	–	–	–	–
Subtotal - Year 2016 McConnell AFB FTU Scenario [b]	–	–	–	–	–
Subtotal - Year 2016 McConnell AFB MOB 1 Scenario[c]	–	–	–	–	–

[a] 2012 McConnell AFB AGE emissions = Fairchild AFB 2012 emissions * McConnell AFB 2012 total LTOs/ Fairchild AFB 2012 total LTOs.

[b] 2016 McConnell AFB existing aircraft AGE emissions for the FTU scenario = 2012 Fairchild AFB AGE emissions * (McConnell AFB 2016 nonroad EFs/2012 Fairchild AFB nonroad EFs).

[c] 2016 McConnell AFB existing aircraft AGE emissions for the MOB 1 scenario = 2012 Fairchild AFB AGE emissions * (McConnell AFB 2016 transient aircraft LTOs/ Fairchild AFB 2012 LTOs) *(McConnell AFB 2016 nonroad EFs/2012 Fairchild AFB nonroad EFs).

Key: AFB = Air Force Base, AGE = aerospace ground equipment, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, Efs = emission factors, FTU = Formal Training Unit, LTO = landing and takeoff, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-7. Existing Aircraft On-Wing Engine Testing Activity Data for McConnell AFB – Year 2012

Aircraft/Test Type	Tests/Year	# of Engines	Duration (Minutes)	Engine Setting/Annual Engine Hours			
				Idle	Approach	Intermediate	Takeoff
KC-135 [a]							
Pre-Flight Run - Assume part of LTO							
Idle Run	3,380	1	10	563.3	–	–	–
Mid-Power Run	2,080	2	10	693.3	–	–	–
Mid-Power Run	2,080	2	60	–	–	520.0	–
Power Run	1,560	2	10	520.0	–	–	–
Power Run	1,560	2	30	–	–	–	195.0
Transient	10	2	10	3.3	–	–	–
Transient	10	2	30	–	–	–	1.3
Total Time In Modes - KC-135				**1,780**	–	**520**	**196**

[a] Source is SAIC 2013m.

Key: # = number, LTO = landing and takeoff, TIM = Time in Mode.

Table D.4-8. Annual Air Emissions from Existing Aircraft On-Wing Engine Testing Activities for McConnell AFB – Year 2012

Scenario/Engine Type	Annual Emissions - Tons									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
KC-135										
Idle	1.90	27.70	3.61	0.96	0.05	0.05	2,902	0.08	0.09	2,931
Approach	–	–	–	–	–	–	–	–	–	–
Intermediate	0.10	0.15	26.98	1.79	0.08	0.08	5,424	0.15	0.17	5,479
Military	0.04	0.07	14.16	0.81	0.05	0.05	2,462	0.07	0.08	2,487
Subtotal KC-135	**2.03**	**27.92**	**44.75**	**3.56**	**0.19**	**0.19**	**10,787**	**0.30**	**0.34**	**10,897**
Total Emissions - 2012	**2.03**	**27.92**	**44.75**	**3.56**	**0.19**	**0.19**	**10,787**	**0.30**	**0.34**	**10,897**

Scenario/Engine Type	Annual Emissions - Tons									
	Acetal-dehyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	o-Cresol	p-Cresol
KC-135										
Idle	–	–	0.002	–	–	–	0.002	0.001	–	–
Approach	–	–	–	–	–	–	–	–	–	–
Intermediate	–	–	0.001	–	–	0.001	0.003	0.001	–	–
Military	–	–	0.001	–	–	–	0.001	0.000	–	–
Subtotal KC-135	–	–	**0.003**	–	–	**0.001**	**0.006**	**0.002**	–	–
Total Emissions - 2012	–	–	**0.003**	–	–	**0.001**	**0.006**	**0.002**	–	–

Scenario/Engine Type	Annual Emissions - Tons									
	Dibenzo-furan	Dibutyl Phthalate	1,2-Dichloro-propane	2,4-Dinitro-phenol	Di(2-Ethyl-hexyl) Phthalate (DEHP)	Ethyl-benzene	Formal-dehyde	Hexane	Methanol	Methylene Chloride
KC-135										
Idle	–	–	–	–	0.005	0.001	0.086	–	–	0.061
Approach	–	–	–	–	–	–	–	–	–	–
Intermediate	–	–	–	–	0.008	–	0.009	–	–	0.085
Military	–	–	–	–	0.001	–	0.005	–	–	0.002
Subtotal KC-135	–	–	–	–	**0.014**	**0.001**	**0.101**	–	–	**0.148**
Total Emissions - 2012	–	–	–	–	**0.014**	**0.001**	**0.101**	–	–	**0.148**

Scenario/Engine Type	Annual Emissions - Tons									
	MIBK	MTBE	Naphth-alene	Phenol	POM	Propio-nalde-hyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetra-chloro-ethene	Toluene
KC-135										
Idle	–	–	0.003	–	–	–	0.001	–	0.002	0.008
Approach	–	–	–	–	–	–	–	–	–	–
Intermediate	–	–	–	–	–	–	–	–	0.001	0.002
Military	–	–	–	–	–	–	–	–	0.001	0.001
Subtotal KC-135	–	–	**0.003**	–	–	–	**0.001**	–	**0.003**	**0.011**
Total Emissions - 2012	–	–	**0.003**	–	–	–	**0.001**	–	**0.003**	**0.011**

Scenario/Engine Type	Annual Emissions - Tons				
	1,1,1-Trichloro-ethane	Trichloro-ethEne	Vinyl Acetate	mp-Xylene	o-Xylene
KC-135					
Idle	0.001	–	0.004	0.001	–
Approach	–	–	–	–	–
Intermediate	–	–	0.004	0.001	–
Military	0.000	–	0.002	0.000	–
Subtotal KC-135	**0.001**	–	**0.011**	**0.003**	–
Total Emissions - 2012	**0.001**	–	**0.011**	**0.003**	–

Key: CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-9. Annual Aircraft LTOs – McConnell AFB KC-46A Project Scenarios

Aircraft	Annual LTOs			
	Fairchild AFB 2012	*McConnell AFB 2012*	*McConnell AFB FTU*	*McConnell AFB MOB 1*
KC-135	1,474	2,771	2,771	–
UH-60	1,302	–	–	–
UH-1N	412	–	–	–
Transient	975	2,838	2,838	2,838
KC-46A	–	–	1,827	2,815
Total LTOs	**4,162**	**5,609**	**7,435**	**5,653**

Key: AFB = Air Force Base, FTU = Formal Training Unit, LTO = landing and takeoff, MOB 1 = First Main Operating Base.

Table D.4-10. Annual Average Nonroad Emission Factors – McConnell AFB KC-46A Scenarios

HP Category/Fuel Type	Emission Factors (Grams/Horsepower) [a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 - Fairchild AFB										
100-175 HP Diesel	0.54	3.92	4.58	0.13	0.61	0.56	608	0.094	0.007	612
Year 2016 McConnell AFB										
100-175 HP Diesel	0.38	2.75	3.11	0.12	0.46	0.42	608	0.094	0.007	613

[a] Year 2012/2016 factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Spokane/Sedgwick Counties.

Key: AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, HP = horsepower, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-11. Annual Air Emissions for AGE Usages by KC-46A Aircraft – McConnell AFB KC-46A Scenarios

Scenario/Source	Annual Emissions - Tons									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 - Fairchild AFB										
Aerospace Ground Support Equipment	1.24	8.89	10.45	0.30	1.38	1.27	1,385	0.21	0.02	1,395
Subtotal - Year 2008	**1.24**	**8.89**	**10.45**	**0.30**	**1.38**	**1.27**	**1,385**	**0.21**	**0.02**	**1,395**
Year 2016 - McConnell AFB FTU Scenario										
Aerospace Ground Support Equipment[a]	0.38	2.74	3.11	0.12	0.46	0.42	608	0.09	0.01	613
Subtotal - FTU Scenario	**0.38**	**2.74**	**3.11**	**0.12**	**0.46**	**0.42**	**608**	**0.09**	**0.01**	**613**
Year 2016 - McConnell AFB MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.59	4.22	4.80	0.18	0.71	0.65	937	0.14	0.01	943
Subtotal - MOB 1 Scenario	**0.59**	**4.22**	**4.80**	**0.18**	**0.71**	**0.65**	**937**	**0.14**	**0.01**	**943**

Scenario/Source	Annual Emissions - Tons									
	Acetal-dehyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
Year 2012 - Fairchild AFB										
Aerospace Ground Support Equipment	0.09	0.014	0.025	0.002	–	–	–	–	–	–
Subtotal - Year 2008	**0.09**	**0.014**	**0.025**	**0.002**	–	–	–	–	–	–
Year 2016 - McConnell AFB FTU Scenario										
Aerospace Ground Support Equipment[a]	0.03	0.004	0.008	0.001	–	–	–	–	–	–
Subtotal - FTU Scenario	**0**	**0.004**	**0.008**	**0.001**	–	–	–	–	–	–
Year 2016 - McConnell AFB MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.04	0.007	0.012	0.001	–	–	–	–	–	–
Subtotal - MOB 1 Scenario	**0**	**0.007**	**0.012**	**0.001**	–	–	–	–	–	–

Table D.4-11. Annual Air Emissions for AGE Usages by KC-46A Aircraft – McConnell AFB KC-46A Scenarios (Continued)

Scenario/Source	Annual Emissions - Tons									
	Dibenz-ofuran	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*Di(2-Ethyl-hexyl) Phthalate (DEHP)*	*Ethyl-benzene*	*Formalde-hyde*	*Hexane*	*Methanol*	*Methylene Chloride*
Year 2012 - Fairchild AFB										
Aerospace Ground Support Equipment	–	–	0.004	0.185	0.002	–	–	–	–	–
Subtotal - Year 2008	–	–	**0.004**	**0.185**	**0.002**	–	–	–	–	–
Year 2016 - McConnell AFB FTU Scenario										
Aerospace Ground Support Equipment[a]	–	–	0.001	0.057	0.001	–	–	–	–	–
Subtotal - FTU Scenario	–	–	**0.001**	**0.057**	**0.001**	–	–	–	–	–
Year 2016 - McConnell AFB MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	–	–	0.002	0.088	0.001	–	–	–	–	–
Subtotal - MOB 1 Scenario	–	–	**0.002**	**0.088**	**0.001**	–	–	–	–	–

Scenario/Source	Annual Emissions - Tons									
	MIBK	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propio-nalde-hyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*
Year 2012 - Fairchild AFB										
Aerospace Ground Support Equipment	0.000	0.012	0.001	–	–	0.019	–	–	–	0.013
Subtotal - Year 2008	**0.000**	**0.012**	**0.001**	–	–	**0.019**	–	–	–	**0.013**
Year 2016 - McConnell AFB FTU Scenario										
Aerospace Ground Support Equipment[a]	0.000	0.004	0.000	–	–	0.006	–	–	–	0.004
Subtotal - FTU Scenario	**0.000**	**0.004**	**0.000**	–	–	**0.006**	–	–	–	**0.004**
Year 2016 - McConnell AFB MOB 1 Scenario										
Aerospace Ground Support Equipment[a]	0.000	0.006	0.000	–	–	0.009	–	–	–	0.006
Subtotal - MOB 1 Scenario	**0.000**	**0.006**	**0.000**	–	–	**0.009**	–	–	–	**0.006**

Scenario/Source	Annual Emissions - Tons				
	1,1,1-Trichloro-ethane	*Trichloro-ethene*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Year 2012 - Fairchild AFB					
Aerospace Ground Support Equipment	–	–	–	–	–
Subtotal - Year 2008	–	–	–	–	–
Year 2016 - McConnell AFB FTU Scenario					
Aerospace Ground Support Equipment[a]	–	–	–	–	–
Subtotal - FTU Scenario	–	–	–	–	–
Year 2016 - McConnell AFB MOB 1 Scenario					
Aerospace Ground Support Equipment[a]	–	–	–	–	–
Subtotal - MOB 1 Scenario	–	–	–	–	–

[a] Future year AGE emissions = 2012 Fairchild AGE emissions times the ratio of future year/2012 Fairchild worker populations * scenario year nonroad emission factor/2012 nonroad emission factor.

Key: AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-12. Annual GMV/Nonroad Equipment Usages – McConnell AFB Project Scenarios

Fuel Type	Annual Hp-Hr [a]				
	2012	Year 2016 FTU	Year 2016 MOB 1	Year 2016 FTU Only	Year 2016 MOB 1 Only
Biodiesel	4,161,433	4,745,312	3,554,233	583,879	1,624,669
Diesel	654,544	746,381	559,039	91,837	255,541
Totals	**4,815,977**	**5,491,693**	**4,113,272**	**675,716**	**1,880,210**

[a] Future year estimates based on ratio of future year/2012 Fairchild AFB worker populations.

Key: AFB = Air Force Base, FTU = Formal Training Unit, Hp = horsepower, Hr = hour, MOB 1 = First Main Operating Base.

Table D.4-13. Annual Number of Workers – McConnell AFB KC-46A Project Scenarios

Scenario	Total # of Workers [a]	Fraction of 2012	# of Workers per Scenario	Fraction of 2012
Year 2012	4,818	–	–	–
Year 2016 FTU	5,494	1.14	676	0.14
Year 2016 MOB 1	4,115	0.85	1,881	0.39

[a] EIS Tables 2-18 and 2-21.

Key: # = number, FTU = Formal Training Unit, MOB 1 = First Main Operating Base.

Table D.4-14. Annual Average Nonroad Emission Factors – McConnell AFB KC-46A Scenarios

Scenario/Vehicle Class	Emission Factors (Grams/Hp-Hr) [a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
Nonroad Equipment - 176-300 Hp - Biodiesel	0.30	1.72	4.17	0.11	0.33	0.20	547	0.094	0.007	551
Nonroad Equipment - 176-300 Hp - Diesel	0.38	1.72	4.09	0.11	0.38	0.20	547	0.094	0.007	551
Year 2016 FTU or MOB 1										
Nonroad Equipment - 176-300 Hp - Biodiesel	0.23	1.12	2.72	0.10	0.26	0.20	547	0.094	0.007	551
Nonroad Equipment - 176-300 Hp - Diesel	0.29	1.12	2.67	0.10	0.30	0.20	547	0.094	0.007	551

[a] Factors estimated with the use of the EPA NONROAD2008a model (USEPA 2009) for Sedgwick County. Biodiesel EFs reduced according to EPA 2002.

Key: CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EFs = emission factors, EPA = Environmental Protection Agency, FTU = Formal Training Unit, Hp = horsepower, Hr = hour, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-15. Annual Emissions from GMV/Nonroad Equipment Usages – McConnell AFB KC-46A Scenarios

Scenario/Vehicle Class	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
Nonroad - Biodiesel	1.39	7.89	19.14	0.50	1.53	0.92	2,509.15	0.43	0.03	2,527.74
Nonroad - Diesel	0.27	1.24	2.95	0.08	0.27	0.14	394.66	0.07	0.00	397.58
Total	**1.67**	**9.13**	**22.09**	**0.58**	**1.81**	**1.06**	**2,903.81**	**0.50**	**0.04**	**2,925.32**
Year 2016 FTU										
Nonroad - Biodiesel	1.21	5.86	14.25	0.52	1.38	1.05	2,861.21	0.49	0.04	2,882.40
Nonroad - Diesel	0.24	0.92	2.20	0.08	0.25	0.16	450.03	0.08	0.01	453.37
Total	**1.45**	**6.78**	**16.44**	**0.61**	**1.63**	**1.21**	**3,311.24**	**0.57**	**0.04**	**3,335.76**
Year 2016 MOB 1										
Nonroad - Biodiesel	0.91	4.39	10.67	0.39	1.03	0.78	2,143.04	0.37	0.03	2,158.91
Nonroad - Diesel	0.18	0.69	1.65	0.06	0.18	0.12	337.07	0.06	0.00	339.57
Total	**1.09**	**5.08**	**12.32**	**0.45**	**1.22**	**0.91**	**2,480.11**	**0.43**	**0.03**	**2,498.48**
Year 2016 FTU Only										
Nonroad - Biodiesel	0.15	0.72	1.75	0.06	0.17	0.13	352.05	0.06	0.00	354.66
Nonroad - Diesel	0.03	0.11	0.27	0.01	0.03	0.02	55.37	0.01	0.00	55.78
Total	**0.18**	**0.83**	**2.02**	**0.07**	**0.20**	**0.15**	**407.43**	**0.07**	**0.00**	**410.44**
Year 2016 MOB 1 Only										
Nonroad - Biodiesel	0.42	2.01	4.88	0.18	0.47	0.36	979.60	0.17	0.01	986.86
Nonroad - Diesel	0.08	0.32	0.75	0.03	0.08	0.06	154.08	0.03	0.00	155.22
Total	**0.50**	**2.32**	**5.63**	**0.21**	**0.56**	**0.41**	**1,133.68**	**0.19**	**0.01**	**1,142.08**

Note: Future year emissions = 2008 emissions * scenario worker fraction of 2008 * scenario year vehicle emission factor/ 2008 vehicle emission factor.

Key: CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-16. Annual On Base On-Road Vehicle Mileage Calculations – McConnell AFB KC-46A Project Scenarios

Scenario	# of Workers	Worker Fraction of	Days per Year	Vehicle Occupancy	Round Trips per Year	Miles per Round Trip[a]	Annual On Base VMT
Year 2012	4,818	–	260	0.95	1,190,046	3.0	3,570,138
Year 2016 FTU Only	676	0.14	260	0.95	166,972	3.0	500,916
Year 2016 MOB 1 Only	1,881	0.39	260	0.95	464,607	3.0	1,393,821
Year 2016 FTU Total Base	5,494	1.14	260	0.95	1,357,018	3.0	4,071,054
Year 2016 MOB 1 Total Base	4,115	0.85	260	0.95	1,016,405	3.0	3,049,215

[a] Estimated from base gate/roadway systems.

Key: # = number, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, VMT = vehicle miles traveled.

Table D.4-17. Annual Average On-Road Emission Factors – McConnell AFB KC-46A Proposed Actions

Project Year/Source Type	Emission Factors (Grams/Mile) [a]									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV - Road 3	0.06	2.17	0.39	0.00	0.02	0.01	321	0.00	0.00	321
HDDV - Road 3	0.42	2.51	10.36	0.01	0.56	0.50	1,949	0.00	0.00	1,949
Composite [b]	0.06	2.17	0.42	0.00	0.02	0.01	326	0.00	0.00	326
Year 2016 FTU										
LDGV - Road 3	0.03	1.60	0.19	0.00	0.02	0.01	302	0.00	0.00	302
HDDV - Road 3	0.25	1.57	6.44	0.01	0.36	0.30	1,949	0.00	0.00	1,949
Composite [b]	0.03	1.60	0.21	0.00	0.02	0.01	307	0.00	0.00	307

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Sedgwick County.

[b] Equal to 99.7/0.3% LDGV/HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicles, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-18. Annual Emissions from On Base On-Road Vehicle Activities – McConnell AFB KC-46A Scenarios

Scenario Year/Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012	0.24	8.49	1.64	0.02	0.08	0.04	1,275	0.00	0.00	1,275
Year 2016 FTU Only	0.02	0.88	0.12	0.00	0.01	0.00	169	0.00	0.00	169
Year 2016 MOB 1 Only	0.05	2.44	0.32	0.01	0.03	0.01	469	0.00	0.00	469
Year 2016 FTU Total Base	0.13	7.13	0.94	0.02	0.08	0.04	1,370	0.00	0.00	1,371
Year 2016 MOB 1 Total Base	0.10	5.34	0.70	0.02	0.06	0.03	1,026	0.00	0.00	1,027

Note: Future year emissions = 2008 emissions * scenario worker fraction of 2008 * scenario year composite emission factor/ 2008 composite emission factor.

Key: CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-19. Annual On Base On-Road Vehicle Mileage Calculations – McConnell AFB KC-46A Project Scenarios

Scenario	# of Workers	Worker Fraction of 2012	Days per Year	Vehicle Occupancy Rate	Round Trips per Year	Miles per Round Trip [a]	Annual On Base VMT
Year 2012	4,818	–	260	0.95	1,190,046	12.0	14,280,552
Year 2016 FTU Only	676	0.14	260	0.95	166,972	12.0	2,003,664
Year 2016 MOB 1 Only	1,881	0.39	260	0.95	464,607	12.0	5,575,284
Year 2016 FTU Total Base	5,494	1.14	260	0.95	1,357,018	12.0	16,284,216
Year 2016 MOB 1 Total Base	4,115	0.85	260	0.95	1,016,405	12.0	12,196,860

[a] Distance from McConnell AFB to the center of Wichita.

Key: # = number, AFB = Air Force Base, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, VMT = vehicle miles traveled.

Table D.4-20. MOBILE6.2 Annual Average On-Road Emission Factors – McConnell AFB KC-46A Proposed Actions

Project Year/Source Type	Emission Factors (Grams/Mile) [a]									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV - Road 3	0.06	2.17	0.39	0.00	0.02	0.01	321	0.0006	0.0001	321
LDGV - Road 5	0.09	2.79	0.41	0.01	0.04	0.01	397	0.0008	0.0002	398
LDGV - Composite [b]	0.08	2.64	0.41	0.01	0.03	0.01	378	0.0008	0.0002	386
HDDV - Road 3	0.42	2.51	10.36	0.01	0.56	0.50	1,949	0.0010	0.0009	1,949
HDDV - Road 5	0.66	3.67	12.74	0.02	1.00	0.83	2,426	0.0012	0.0011	2,427
HDDV - Composite [b]	0.60	3.38	12.15	0.02	0.89	0.74	2,307	0.0012	0.0011	2,355
Year 2016 FTU										
LDGV - Road 3	0.03	1.60	0.19	0.00	0.02	0.01	302	0.0006	0.0001	302
LDGV - Road 5	0.04	2.05	0.19	0.01	0.03	0.01	374	0.0007	0.0002	374
LDGV - Composite [b]	0.04	1.94	0.19	0.01	0.03	0.01	356	0.0007	0.0001	356
HDDV - Road 3	0.25	1.57	6.44	0.01	0.36	0.30	1,949	0.0010	0.0009	1,949
HDDV - Road 5	0.40	2.29	8.00	0.02	0.67	0.51	2,427	0.0012	0.0011	2,427
HDDV - Composite [b]	0.37	2.11	7.61	0.02	0.59	0.46	2,307	0.0012	0.0011	2,308

[a] Estimated with the use of the EPA MOVES2010b model (USEPA 2013) and based upon default parameters for Sedgwick County

[b] Equal to 25/75% road 3/road 5 conditions.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, EPA = Environmental Protection Agency, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-21. Annual Emissions from Off-Base Vehicle Activities – McConnell AFB KC-46A Scenarios

Scenario Year/Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012										
LDGV	1.21	40.41	6.22	0.09	0.48	0.20	5,802	0.01	0.00	5,920
HDDV	0.19	1.06	3.80	0.01	0.28	0.23	722	0.00	0.00	737
Total	**1.40**	**41.47**	**10.02**	**0.09**	**0.75**	**0.43**	**6,524**	**0.01**	**0.00**	**6,657**
Year 2016 FTU Only										
LDGV	0.08	4.16	0.42	0.01	0.06	0.03	766	0.00	0.00	766
HDDV	0.02	0.09	0.33	0.00	0.03	0.02	101	0.00	0.00	101
Total	**0.09**	**4.26**	**0.75**	**0.01**	**0.09**	**0.05**	**867**	**0.00**	**0.00**	**867**
Year 2016 MOB 1 Only										
LDGV	0.21	11.59	1.16	0.03	0.18	0.07	2,130	0.00	0.00	2,130
HDDV	0.04	0.26	0.93	0.00	0.07	0.06	282	0.00	0.00	282
Total	**0.25**	**11.85**	**2.09**	**0.03**	**0.25**	**0.13**	**2,412**	**0.00**	**0.00**	**2,412**
Year 2016 FTU Total Base										
LDGV	0.61	33.85	3.39	0.09	0.52	0.21	6,222	0.01	0.00	6,223
HDDV	0.13	0.75	2.72	0.01	0.21	0.16	823	0.00	0.00	824
Total	**0.74**	**34.60**	**6.10**	**0.10**	**0.73**	**0.37**	**7,045**	**0.01**	**0.00**	**7,046**
Year 2016 MOB 1 Total Base										
LDGV	0.46	25.35	2.54	0.07	0.39	0.15	4,660	0.01	0.00	4,661
HDDV	0.10	0.56	2.03	0.00	0.16	0.12	617	0.00	0.00	617
Total	**0.56**	**25.92**	**4.57**	**0.07**	**0.55**	**0.28**	**5,277**	**0.01**	**0.00**	**5,278**

Notes: Assumes that 2% of the fleet is HDDV.

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, HDDV = heavy duty diesel vehicle, LDGV = light duty gasoline vehicle, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-22. Annual Emissions from Mobile Fuel Transfer Activities – McConnell AFB KC-46A Scenarios.

Scenario	# of Workers	Worker Fraction of 2012	Tons per Year									
			VOC	*Benzene*	*Cumene*	*Ethyl-benzene*	*Hexane*	*MTBE*	*Naph-thalene*	*Toluene*	2,2,4 Trimethyl-pentane	*Xylenes*
Year 2008 Altus	4,062	–	0.10	0.0006	0.0003	0.0002	0.00006	0.00047	0.00000	0.00108	0.00010	0.00165
Year 2012 McConnell AFB	4,818	1.19	0.11	0.0007	0.0003	0.0003	0.0001	0.0006	0.0000	0.0013	0.0001	0.0020
Year 2016 FTU Only	676	0.17	0.02	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0002	0.0000	0.0003
Year 2016 MOB 1 Only	1,881	0.46	0.04	0.0003	0.0001	0.0001	0.0000	0.0002	0.0000	0.0005	0.0000	0.0008
Year 2016 FTU Total Base	5,494	1.35	0.13	0.0008	0.0004	0.0003	0.0001	0.0006	0.0000	0.0015	0.0001	0.0022
Year 2016 MOB 1 Total Base	4,115	1.01	0.10	0.0006	0.0003	0.0002	0.0001	0.0005	0.0000	0.0011	0.0001	0.0017

Notes: Future year emissions = 2008 emissions * future year fraction of 2008 worker population.

Key: # = number, AFB = Air Force Base, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, VOC = volatile organic compound.

Table D.4-23. Annual Emissions from Point and Area Sources – McConnell AFB KC-46A Scenarios.

Scenario Year/Source Type	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Year 2012 [a]	–	7.96	11.94	0.27	–	–	–	–	–	–
Year 2016 FTU Only	–	1.12	1.68	0.04	–	–	–	–	–	–
Year 2016 MOB 1 Only	–	3.11	4.66	0.11	–	–	–	–	–	–
Year 2016 FTU Total Base	–	9.08	13.62	0.31	–	–	–	–	–	–
Year 2016 MOB 1 Total Base	–	6.80	10.20	0.23	–	–	–	–	–	–

[a] Source: (McConnell AFB 2013).

Key: AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, MOB 1 = First Main Operating Base, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-24. Annual Emissions for Existing Operations at McConnell AFB – Year 2012

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
KC-135 Aircraft Operations	10.89	176.49	291.09	27.06	1.47	1.47	82,089	2.27	2.55	75,389
Transient Aircraft	11.89	52.46	97.63	8.46	6.72	6.72	22,513	0.62	0.70	20,676
On-Wing Aircraft Engine Testing - KC-135	2.03	27.92	44.75	3.56	0.19	0.19	10,787	0.30	0.34	9,907
Aerospace Ground Support Equipment	1.67	11.98	14.08	0.40	1.86	1.71	1,867	0.29	0.02	1,708
GMVs/Nonroad Equipment	1.67	9.13	22.09	0.58	1.81	1.06	2,904	0.50	0.04	2,659
Privately-Owned Vehicles - On-Base	0.24	8.49	1.64	0.02	0.08	0.04	1,275	0.00	0.00	1,159
Privately-Owned Vehicles - Off-Base	1.40	41.47	10.02	0.09	0.75	0.43	6,524	0.01	0.00	6,052
Mobile Fuel Transfer Operations	0.11	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	7.96	11.94	0.27	–	–	–	–	–	–
Total Emissions [a]	**40.79**	**335.90**	**493.25**	**40.43**	**12.89**	**11.63**	**127,960**	**4.00**	**3.65**	**117,551**

Source Type	Tons per Year									
	Acetal-dehyde	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
KC-135 Aircraft Operations	–	–	0.04	–	–	0.01	0.05	0.02	–	–
Transient Aircraft	0.03	0.03	0.05	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	0.00	–	–	0.00	0.01	0.00	–	–
Aerospace Ground Support Equipment	0.12	0.02	0.03	0.00	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.00	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Emissions [a]	**0.15**	**0.05**	**0.13**	**0.00**	–	**0.01**	**0.05**	**0.02**	–	–

Table D.4-24. Annual Emissions for Existing Operations at McConnell AFB – Year 2012 (Continued)

Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*
KC-135 Aircraft Operations	–	–	–	–	–	0.08	0.01	0.63	–	–
Transient Aircraft	–	–	–	–	–	–	0.01	0.18	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	0.01	0.00	0.10	–	–
Aerospace Ground Support Equipment	–	–	–	0.01	0.25	0.00	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.00	–	–	–	–	–	0.00	–	0.00	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Emissions [a]	**0.00**	**–**	**–**	**0.01**	**0.25**	**0.10**	**0.01**	**0.91**	**0.00**	**–**

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propionald-ehyde*	*Styrene*	*1,1,2,2-Tetrachlor oethane*	*Tetra-chloro-ethene*
KC-135 Aircraft Operations	1.17	–	–	0.01	–	–	–	0.01	–	0.04
Transient Aircraft	–	–	–	0.02	–	–	–	0.01	–	–
On-Wing Aircraft Engine Testing - KC-135	0.15	–	–	0.00	–	–	–	0.00	–	0.00
Aerospace Ground Support Equipment	–	0.00	0.02	0.00	–	–	0.03	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.00	0.00	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Emissions [a]	**1.32**	**0.00**	**0.02**	**0.03**	**–**	**–**	**0.03**	**0.02**	**–**	**0.05**

Source Type	Tons per Year						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4 Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-135 Aircraft Operations	0.11	0.01	–	0.09	0.03	–	–
Transient Aircraft	0.02	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	0.01	0.00	–	0.01	0.00	–	–
Aerospace Ground Support Equipment	0.02	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.00	–	–	0.00	–	–	0.00
Point and Area Sources	–	–	–	–	–	–	–
Total Emissions [a]	**0.17**	**0.01**	**–**	**0.10**	**0.03**	**–**	**0.00**

[a] Data from 2008 Mobile Source Air Emissions Inventory for Altus Air Force Base (Weston Solutions, Inc. 2008), except point and area sources obtained from 2008 Air Emissions Inventory Turn – Around Document (ODEQ 2010) and Off-Base POV emissions calculated with the use of typical trip lengths. However, CO_2 emissions estimated with widely acceptable factors.

Key: CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMVs = government motor vehicles, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-25. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at McConnell AFB – Year 2016

Source Type	Tons per Year									
	VOC	*CO*	*NO_X*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e (mt)*
KC-46A Aircraft Operations	34.63	157.55	1,034.50	54.09	3.35	2.84	163,451	4.52	5.08	150,110
On-Wing Aircraft Engine Testing - KC-46A	14.14	48.41	23.62	1.88	0.17	0.15	5,690	0.16	0.18	5,226
Aerospace Ground Support Equipment - KC-46A	0.38	2.74	3.11	0.12	0.46	0.42	608	0	0	557
KC-135 Aircraft Operations	10.89	176.49	291.09	27.06	1.47	1.47	82,089	2	3	75,389
Transient Aircraft Operations	11.89	52.46	97.63	8.46	6.72	6.72	22,513	1	1	20,676
On-Wing Aircraft Engine Testing - KC-135	2.03	27.92	44.75	3.56	0.19	0.19	10,787	0	0	9,907
Aerospace Ground Support Equipment - Existing Aircraft	1.17	8.41	9.56	0.37	1.41	1.29	1,868	0	0	1,710
GMVs/Nonroad Equipment	1.45	6.78	16.44	0.61	1.63	1.21	3,311	1	0	3,033
Privately-Owned Vehicles - On-Base	0.13	7.13	0.94	0.02	0.08	0.04	1,370.46	0.00	0.00	1,246
Privately-Owned Vehicles - Off-Base	0.74	34.60	6.10	0.10	0.73	0.37	7,045.00	0.01	0.00	6,406
Mobile Fuel Transfer Operations	0.13	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	9.08	13.62	0.31	–	–	–	–	–	–
Total Proposed Emissions - 2016	**77.60**	**531.55**	**1,541.37**	**96.55**	**16.21**	**14.71**	**298,734**	**9**	**9**	**274,259**
Year 2012 Base Case Emissions	**(40.79)**	**(335.90)**	**(493.25)**	**(40.43)**	**(12.89)**	**(11.63)**	**(127,960)**	**(4)**	**(4)**	**(117,551)**
Proposed Year 2016 minus Base Case Emissions	**36.81**	**195.65**	**1,048.11**	**56.12**	**3.32**	**3.08**	**170,774**	**5**	**5**	**156,708**
PSD Thresholds	**250**	**250**	**250**	**250**	**250**	**250**	**–**	**–**	**–**	**–**
Sedgwick County 2008 Emissions	**27,732**	**103,426**	**20,495**	**1,016**	**43,292**	**6,874**	**–**	**–**	**–**	**3,225,354**
Fractional Increase from Sedgwick County Emissions	**0.001**	**0.002**	**0.05**	**0.06**	**0.0001**	**0.0004**	**–**	**–**	**–**	**0.05**
Fractional Increase from Existing McConnell AFB	**0.90**	**0.58**	**2.12**	**1.39**	**0.26**	**0.27**	**–**	**–**	**–**	**1.33**

Table D.4-25. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Acetal-dehyde	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
KC-46A Aircraft Operations	1.49	0.86	0.59	0.59	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-46A	0.61	0.35	0.24	0.24	–	–	–	–	–	–
Aerospace Ground Support Equipment - KC-46A	0.03	0.00	0.01	0.00	–	–	–	–	–	–
KC-135 Aircraft Operations	–	–	0.04	–	–	0.01	0.05	0.02	–	–
Transient Aircraft Operations	0.03	0.03	0.05	–	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	0.00	–	–	0.00	0.01	0.00	–	–
Aerospace Ground Support Equipment - Existing Aircraft	0.09	0.01	0.02	0.00	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**2.24**	**1.25**	**0.96**	**0.83**	**–**	**0.01**	**0.05**	**0.02**	**–**	**–**
Year 2012 Base Case Emissions	**(0.15)**	**(0.05)**	**(0.13)**	**(0.00)**	**–**	**(0.01)**	**(0.05)**	**(0.02)**	**–**	**–**
Proposed Year 2016 minus Base Case Emissions	**2.09**	**1.20**	**0.82**	**0.83**	**–**	**–**	**–**	**–**	**–**	**–**
PSD Thresholds	–	–	–	–	–	–	–	–	–	–
Sedgwick County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Sedgwick County Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Existing McConnell AFB	**13.76**	**23.42**	**6.16**	**267.36**	**–**	**–**	**–**	**–**	**–**	**–**

Table D.4-25. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*
KC-46A Aircraft Operations	–	–	–	–	–	–	0.06	4.30	–	0.63
On-Wing Aircraft Engine Testing - KC-46A	–	–	–	–	–	–	0.02	1.75	–	0.26
Aerospace Ground Support Equipment - KC-46A	–	–	–	0.00	0.06	0.00	–	–	–	–
KC-135 Aircraft Operations	–	–	–	–	–	0.08	0.01	0.63	–	–
Transient Aircraft Operations	–	–	–	–	–	–	0.01	0.18	–	–
On-Wing Aircraft Engine Testing - KC-135	–	–	–	–	–	0.01	0.00	0.10	–	–
Aerospace Ground Support Equipment - Existing Aircraft	–	–	–	0.00	0.18	0.00	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**–**	**–**	**–**	**0.00**	**0.23**	**0.10**	**0.10**	**6.97**	**–**	**0.89**
Year 2012 Base Case Emissions	**(0.00)**	**–**	**–**	**(0.01)**	**(0.25)**	**(0.10)**	**(0.01)**	**(0.91)**	**(0.00)**	**–**
Proposed Year 2016 minus Base Case Emissions	**(0.00)**	**–**	**–**	**(0.00)**	**(0.02)**	**(0.00)**	**0.09**	**6.05**	**(0.00)**	**0.89**
PSD Thresholds	–	–	–	–	–	–	–	–	–	–
Sedgwick County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Sedgwick County Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Existing McConnell AFB	**(1.00)**	**–**	**–**	**(0.07)**	**(0.07)**	**(0.00)**	**5.97**	**6.62**	**(1.00)**	**–**

Table D.4-25. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naph-thalene*	*Phenol*	*POM*	*Propion-aldehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*
KC-46A Aircraft Operations	–	–	–	0.19	0.25	–	–	0.11	–	–
On-Wing Aircraft Engine Testing - KC-46A	–	–	–	0.08	0.10	–	–	0.04	–	–
Aerospace Ground Support Equipment - KC-46A	–	0.00	0.00	0.00	–	–	0.01	–	–	–
KC-135 Aircraft Operations	1.17	–	–	0.01	–	–	–	0.01	–	0.04
Transient Aircraft Operations	–	–	–	0.02	–	–	–	0.01	–	–
On-Wing Aircraft Engine Testing - KC-135	0.15	–	–	0.00	–	–	–	0.00	–	0.00
Aerospace Ground Support Equipment - Existing Aircraft	–	0.00	0.01	0.00	–	–	0.02	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**1.32**	**0.00**	**0.02**	**0.30**	**0.36**	**–**	**0.02**	**0.17**	**–**	**0.05**
Year 2012 Base Case Emissions	**(1.32)**	**(0.00)**	**(0.02)**	**(0.03)**	**-**	**–**	**(0.03)**	**(0.02)**	**–**	**(0.05)**
Proposed Year 2016 minus Base Case Emissions	**–**	**(0.00)**	**(0.00)**	**0.27**	**0.36**	**–**	**(0.00)**	**0.15**	**–**	**–**
PSD Thresholds	–	–	–	–	–	–	–	–	–	–
Sedgwick County 2008 Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Sedgwick County Emissions	–	–	–	–	–	–	–	–	–	–
Fractional Increase from Existing McConnell AFB	**–**	**(0.07)**	**(0.10)**	**8.38**	**–**	**–**	**(0.07)**	**9.76**	**–**	**–**

Table D.4-25. Summary of Total Annual Emissions Associated with the KC-46A FTU Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	2,2,4 Trimethyl-pentane	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-46A Aircraft Operations	0.22	–	–	–	–	0.10	0.06
On-Wing Aircraft Engine Testing - KC-46A	0.09	–	–	–	–	0.04	0.02
Aerospace Ground Support Equipment - KC-46A	0.00	–	–	–	–	–	–
KC-135 Aircraft Operations	0.11	0.01	–	–	0.09	0.03	–
Transient Aircraft Operations	0.02	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-135	0.01	0.00	–	–	0.01	0.00	–
Aerospace Ground Support Equipment - Existing Aircraft	0.01	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.48**	**0.01**	**–**	**–**	**0.10**	**0.17**	**0.08**
Year 2012 Base Case Emissions	**(0.17)**	**(0.01)**	**–**	**(0.10)**	**(0.03)**	**–**	**(0.00)**
Proposed Year 2016 minus Base Case Emissions	**0.31**	**–**	**–**	**(0.10)**	**0.07**	**0.17**	**0.08**
PSD Thresholds	–	–	–	–	–	–	–
Sedgwick County 2008 Emissions	–	–	–	–	–	–	–
Fractional Increase from Sedgwick County Emissions	–	–	–	–	–	–	–
Fractional Increase from Existing McConnell AFB	**1.86**	**–**	**–**	**(1.00)**	**2.17**	**–**	**40.70**

Key: ( ) = parenthesis indicate negative numbers, AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMVs = government motor vehicles, NA = not applicable, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-26. KC-135/KC-46A Aircraft Operations at Clinton Sherman Industrial Airpark – McConnell AFB KC-46A FTU Scenario

Scenario/Operation	Operations per Year	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	60%	Climbout	Takeoff	55%	60%	Climbout	Takeoff
Existing KC-135 [a]									
Closed Pattern - IFR	1,062	12.0	2.0	–	1.0	212	35	–	18
Closed Pattern - VFR	434	5.0	2.0	–	1.0	36	14	–	7
Total TIMs - Existing KC-135						**249**	**50**	**–**	**25**
KC-46A - FTU [a]									
Closed Pattern - Radar & Initial to Overhead	347	12.0	2.0	–	1.0	69	12	–	6
Closed Pattern - VFR	142	5.0	2.0	–	1.0	12	5	–	2
Total TIMs - KC-46A FTU						**81**	**16**	**–**	**8**

[a] Source is SAIC 2013h.

Key: % = percent, FTU = Formal Training Unit, IFR = instrument flight rules, TIM = Time in Mode, VFR = visual flight rules.

Table D.4-27. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Clinton Sherman Industrial Airpark – McConnell AFB KC-46A FTU Scenario

Scenario/Engine Setting	Tons per Year									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Existing KC-135										
55%	0.16	4.98	25.06	2.26	0.12	0.12	6,862	0	0	6,932
60%	0.03	0.91	5.79	0.49	0.03	0.03	1,494	0	0	1,509
Take-off	0.02	0.04	7.20	0.41	0.03	0.03	1,251	0	0	1,264
Subtotal Existing KC-135	**0.21**	**5.92**	**38.04**	**3.17**	**0.17**	**0.17**	**9,607**	**0**	**0**	**9,705**
KC-46A - FTU										
55%	0.08	1.12	16.14	0.93	0.05	0.04	2,814	0	0	2,842
60%	0.02	0.22	3.78	0.20	0.01	0.01	618	0	0	624
Take-off	0.02	0.11	6.05	0.19	0.01	0.01	566	0	0	572
Subtotal KC-46A FTU	**0.12**	**1.45**	**25.97**	**1.32**	**0.08**	**0.07**	**3,997**	**0**	**0**	**4,038**

Scenario/Engine Setting	Tons per Year									
	CO_2e (mt)	Acetal-dehyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Dibutyl Phthalate
Existing KC-135										
55%	6,302	–	–	0.004	–	–	0.001	0.004	0.002	–
60%	1,372	–	–	0.001	–	–	0.000	0.001	0.000	–
Take-off	1,149	–	–	0.000	–	–	-	0.000	0.000	–
Subtotal Existing KC-135	**8,823**	–	–	**0.005**	–	–	**0.001**	**0.005**	**0.002**	–
KC-46A - FTU										
55%	2,584	0.004	0.002	0.001	0.001	–	–	–	–	–
60%	567	0.001	0.000	0.000	0.000	–	–	–	–	–
Take-off	520	0.001	0.000	0.000	0.000	–	–	–	–	–
Subtotal KC-46A FTU	**3,671**	**0.005**	**0.003**	**0.002**	**0.002**	–	–	–	–	–

Scenario/Engine Setting	Tons per Year									
	1,2-Dichloro-propane	2,4-Dinitro-phenol	DEHP	Ethyl-benzene	Formal-dehyde	Hexane	Methanol	Methylene Chloride	MTBE	Naph-thalene
Existing KC-135										
55%	–	–	0.006	0.001	0.023	–	–	0.101	–	–
60%	–	–	0.001	0.000	0.005	–	–	0.022	–	–
Take-off	–	–	0.001	-	0.003	–	–	0.001	–	–
Subtotal Existing KC-135	–	–	**0.008**	**0.001**	**0.030**	–	–	**0.124**	–	–
KC-46A - FTU										
55%	–	–	–	0.000	0.010	–	0.001	–	–	0.000
60%	–	–	–	0.000	0.002	–	0.000	–	–	0.000
Take-off	–	–	–	0.000	0.002	–	0.000	–	–	0.000
Subtotal KC-46A FTU	–	–	–	**0.000**	**0.014**	–	**0.002**	–	–	**0.001**

Scenario/Engine Setting	Tons per Year										
	Phenol	POM	Propional dehyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetra-chloro-ethene	Toluene	1,1,1-Tri-chloro-ethane	Vinyl Acetate	mp-Xylene	o-Xylene
Existing KC-135											
55%	–	–	–	–	–	0.004	0.009	0.001	0.007	0.002	–
60%	–	–	–	–	–	0.001	0.002	0.000	0.001	0.000	–
Take-off	–	–	–	–	–	0.000	0.000	0.000	0.001	0.000	–
Subtotal Existing KC-135	–	–	–	–	–	**0.005**	**0.011**	**0.001**	**0.009**	**0.003**	–
KC-46A - FTU											
55%	0.001	–	–	0.000	–	–	0.001	–	–	0.000	0.000
60%	0.000	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	0.000	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	**0.001**	–	–	**0.000**	–	–	**0.001**	–	–	**0.000**	**0.000**

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-28. KC-135/KC-46A Aircraft Operations at Lubbock Preston Smith International Airport – McConnell AFB KC-46A FTU Scenario

Scenario/Operation	Operations/ Year	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	60%	Climbout	Takeoff	55%	60%	Climbout	Takeoff
Existing KC-135 [a]									
Closed Pattern - IFR	506	12.0	2.0	–	1.0	101	17	–	8
Closed Pattern - VFR	206	5.0	2.0	–	1.0	17	7	–	3
Total TIMs - Existing KC-135						**118**	**24**	–	**12**
KC-46A - FTU [a]									
Closed Pattern - Radar & Initial to Overhead	347	12.0	2.0	–	1.0	69	12	–	6
Closed Pattern - VFR	142	5.0	2.0	–	1.0	12	5	–	2
Total TIMs - KC-46A FTU						**81**	**16**	–	**8**

[a] Source is SAIC 2013h.

Key: % = percent, FTU = Formal Training Unit, IFR = instrument flight rules, VFR = visual flight rules.

Table D.4-29. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Lubbock Preston Smith International Airport – McConnell AFB KC-46A FTU Scenario

Scenario/Engine Setting	Tons per Year									
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2*	*CH_4*	*N_2O*	*CO_2e*
Existing KC-135										
55%	0.08	2.37	11.93	1.08	0.06	0.06	3,266	0	0	3,299
60%	0.02	0.43	2.75	0.23	0.01	0.01	711	0	0	718
Take-off	0.01	0.02	3.43	0.20	0.01	0.01	595	0	0	602
Subtotal Existing KC-135	**0.10**	**2.82**	**18.11**	**1.51**	**0.08**	**0.08**	**4,572**	**0**	**0**	**4,619**
KC-46A - FTU										
55%	0.08	1.12	16.14	0.93	0.05	0.04	2,814	0	0	2,842
60%	0.02	0.22	3.78	0.20	0.01	0.01	618	0	0	624
Take-off	0.02	0.11	6.05	0.19	0.01	0.01	566	0	0	572
Subtotal KC-46A FTU	**0.12**	**1.45**	**25.97**	**1.32**	**0.08**	**0.07**	**3,997**	**0**	**0**	**4,038**

Scenario/Engine Setting	Tons per Year									
	CO_2e (mt)	*Acetal-dehyde*	*Acrolein*	*Benzene*	1,3-Butadiene	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*Dibutyl Phthalate*
Existing KC-135										
55%	2,999	–	–	0.002	–	–	0.000	0.002	0.001	–
60%	653	–	–	0.000	–	–	0.000	0.000	0.000	–
Take-off	547	–	–	0.000	–	–	–	0.000	0.000	–
Subtotal Existing KC-135	**4,199**	–	–	**0.003**	–	–	**0.001**	**0.002**	**0.001**	–
KC-46A - FTU										
55%	2,584	0.004	0.002	0.001	0.001	–	–	–	–	–
60%	567	0.001	0.000	0.000	0.000	–	–	–	–	–
Take-off	520	0.001	0.000	0.000	0.000	–	–	–	–	–
Subtotal KC-46A FTU	**3,671**	**0.005**	**0.003**	**0.002**	**0.002**	–	–	–	–	–

Scenario/Engine Setting	Tons per Year									
	1,2-Dichloro-propane	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*	*Methylene Chloride*	*MTBE*	*Naph-thalene*
Existing KC-135										
55%	–	–	0.003	0.000	0.011	–	–	0.048	–	–
60%	–	–	0.001	0.000	0.002	–	–	0.011	–	–
Take-off	–	–	0.000	–	0.001	–	–	0.000	–	–
Subtotal Existing KC-135	–	–	**0.004**	**0.000**	**0.014**	–	–	**0.059**	–	–
KC-46A - FTU										
55%	–	–	–	0.000	0.010	–	0.001	–	–	0.000
60%	–	–	–	0.000	0.002	–	0.000	–	–	0.000
Take-off	–	–	–	0.000	0.002	–	0.000	–	–	0.000
Subtotal KC-46A FTU	–	–	–	**0.000**	**0.014**	–	**0.002**	–	–	**0.001**

Scenario/Engine Setting	Tons per Year										
	Phenol	*POM*	*Propional dehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*	*Toluene*	*1,1,1-Trichloro-ethane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
Existing KC-135											
55%	–	–	–	–	–	0.002	0.004	0.000	0.003	0.001	–
60%	–	–	–	–	–	0.000	0.001	0.000	0.001	0.000	–
Take-off	–	–	–	–	–	0.000	0.000	0.000	0.000	0.000	–
Subtotal Existing KC-135	–	–	–	–	–	**0.003**	**0.005**	**0.001**	**0.004**	**0.001**	–
KC-46A - FTU											
55%	0.001	–	–	0.000	–	–	0.001	–	–	0.000	0.000
60%	0.000	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Take-off	0.000	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	**0.001**	–	–	**0.000**	–	–	**0.001**	–	–	**0.000**	**0.000**

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-30. KC-135/KC-46A Aircraft Operations at Wichita Mid-Continent Airport – McConnell AFB KC-46A FTU Scenario

Scenario/Operation	Operations/ Year	Engine Setting/Time in Mode per Operation (Minutes)				Engine Setting Annual Hours			
		55%	60%	Climbout	Takeoff	55%	60%	Climbout	Takeoff
Existing KC-135 [a]									
Closed Pattern - IFR	1,407	12.0	2.0	–	1.0	281	47	–	23
Closed Pattern - VFR	574	5.0	2.0	–	1.0	48	19	–	10
Total TIMs - Existing KC-135						**329**	**66**	–	**33**
KC-46A - FTU [a]									
Closed Pattern - Radar & Initial to Overhead	1,619	12.0	2.0	–	1.0	324	54	–	27
Closed Pattern - VFR	661	5.0	2.0	–	1.0	55	22	–	11
Total TIMs - KC-46A FTU						**379**	**76**	–	**38**

[a] Source is SAIC 2013h.

Key: % = percent, FTU = Formal Training Unit, IFR = instrument flight rules, TIM = Time in Mode, VFR = visual flight rules.

Table D.4-31. Annual Air Emissions from KC-135/KC-46A Aircraft Operations at Rick Husband Amarillo International Airport – McConnell AFB KC-46A FTU Scenario

Scenario/Engine Setting	Tons per Year									
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Existing KC-135										
55%	0.22	6.59	33.19	3.00	0.16	0.16	9,087	0	0	9,180
60%	0.05	1.20	7.66	0.65	0.03	0.03	1,978	0	0	1,998
Take-off	0.02	0.05	9.53	0.55	0.04	0.04	1,657	0	0	1,674
Subtotal Existing KC-135	**0.28**	**7.84**	**50.38**	**4.19**	**0.23**	**0.23**	**12,722**	**0**	**0**	**12,852**
KC-46A - FTU										
55%	0.38	5.23	75.35	4.33	0.24	0.20	13,135	0	0	13,270
60%	0.08	1.03	17.66	0.95	0.05	0.05	2,883	0	0	2,913
Take-off	0.08	0.50	28.24	0.87	0.07	0.06	2,643	0	0	2,670
Subtotal KC-46A FTU	**0.54**	**6.76**	**121.25**	**6.15**	**0.36**	**0.30**	**18,662**	**1**	**1**	**18,852**

Scenario/Engine Setting	Tons per Year									
	CO_2e (mt)	Acetal-dehyde	Acrolein	Benzene	1,3-Butadiene	Carbon Disulfide	Carbon Tetra-chloride	Chloro-form	Chloro-methane	Dibutyl Phthalate
Existing KC-135										
55%	8,345	–	–	0.006	–	–	0.001	0.005	0.002	–
60%	1,817	–	–	0.001	–	–	0.000	0.001	0.001	–
Take-off	1,521	–	–	0.001	–	–	–	0.001	0.000	–
Subtotal Existing KC-135	**11,684**	–	–	**0.007**	–	–	**0.002**	**0.007**	**0.003**	–
KC-46A - FTU										
55%	12,063	0.016	0.009	0.006	0.006	–	–	–	–	–
60%	2,648	0.004	0.002	0.001	0.001	–	–	–	–	–
Take-off	2,427	0.003	0.002	0.001	0.001	–	–	–	–	–
Subtotal KC-46A FTU	**17,138**	**0.023**	**0.013**	**0.009**	**0.009**	–	–	–	–	–

Scenario/Engine Setting	Tons per Year									
	1,2-Dichloro-propane	2,4-Dinitro-phenol	DEHP	Ethyl-benzene	Formal-dehyde	Hexane	Methanol	Methylene Chloride	MTBE	Naph-thalene
Existing KC-135										
55%	–	–	0.008	0.001	0.030	–	–	0.134	–	–
60%	–	–	0.002	0.000	0.006	–	–	0.029	–	–
Take-off	–	–	0.001	–	0.004	–	–	0.001	–	–
Subtotal Existing KC-135	–	–	**0.011**	**0.001**	**0.040**	–	–	**0.164**	–	–
KC-46A - FTU										
55%	–	–	–	0.001	0.047	–	0.007	–	–	0.002
60%	–	–	–	0.000	0.010	–	0.001	–	–	0.000
Take-off	–	–	–	0.000	0.009	–	0.001	–	–	0.000
Subtotal KC-46A FTU	–	–	–	**0.001**	**0.067**	–	**0.010**	–	–	**0.003**

Scenario/Engine Setting	Tons per Year										
	Phenol	POM	Propional-dehyde	Styrene	1,1,2,2-Tetra-chloro-ethane	Tetra-chloro-ethene	Toluene	1,1,1-Trichloro-ethane	Vinyl Acetate	mp-Xylene	o-Xylene
Existing KC-135											
55%	–	–	–	–	–	0.006	0.011	0.001	0.009	0.003	–
60%	–	–	–	–	–	0.001	0.002	0.000	0.002	0.001	–
Take-off	–	–	–	–	–	0.001	0.001	0.000	0.001	0.000	–
Subtotal Existing KC-135	–	–	–	–	–	**0.007**	**0.014**	**0.002**	**0.012**	**0.004**	–
KC-46A - FTU											
55%	0.003	–	–	0.001	–	–	0.002	–	–	0.001	0.001
60%	0.001	–	–	0.000	–	–	0.001	–	–	0.000	0.000
Take-off	0.001	–	–	0.000	–	–	0.000	–	–	0.000	0.000
Subtotal KC-46A FTU	**0.004**	–	–	**0.002**	–	–	**0.003**	–	–	**0.002**	**0.001**

Key: % = percent, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, FTU = Formal Training Unit, mt = metric tons, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, SO_2 = sulfur dioxide, VOC = volatile organic compound.

Table D.4-32. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at McConnell AFB – Year 2016

Source Type	Tons per Year									
	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e (mt)
KC-46A Aircraft Operations	50.07	201.74	837.57	45.42	2.92	2.49	136,814	3.79	4.25	125,648
On-Wing Aircraft Engine Testing - KC-46A	14.39	49.54	28.94	2.34	0.21	0.19	6,844	0.19	0.21	6,286
Aerospace Ground Support Equipment - KC-46A	0.59	4.22	4.80	0.18	0.71	0.65	937	0.14	0.01	858
Transient Aircraft	11.89	52.46	97.63	8.46	6.72	6.72	22,513	1	1	20,676
Aerospace Ground Support Equipment - Existing Aircraft	0.59	4.25	4.84	0.19	0.71	0.65	945	0	0	865
GMVs/Nonroad Equipment	1.09	5.08	12.32	0.45	1.22	0.91	2,480	0	0	2,271
Privately-Owned Vehicles - On-Base	0.10	5.34	0.70	0.02	0.06	0.03	1,026	0.00	0.00	933
Privately-Owned Vehicles - Off-Base	0.56	25.92	4.57	0.07	0.55	0.28	5,277	0.01	0.00	4,798
Mobile Fuel Transfer Operations	0.10	–	–	–	–	–	–	–	–	–
Point and Area Sources	–	6.80	10.20	0.23	–	–	–	–	–	–
Total Proposed Emissions - 2016	**79.37**	**355.33**	**1,001.56**	**57.36**	**13.09**	**11.91**	**176,837**	**5**	**5**	**162,334**
Year 2012 Base Case Emissions	**(40.79)**	**(335.90)**	**(493.25)**	**(40.43)**	**(12.89)**	**(11.63)**	**(127,960)**	**(4)**	**(4)**	**(117,551)**
Proposed Year 2016 minus Base Case Emissions	**38.58**	**19.44**	**508.31**	**16.93**	**0.20**	**0.29**	**48,878**	**1**	**2**	**44,783**
PSD Thresholds	**250**	**250**	**250**	**250**	**250**	**250**				
Sedgwick County 2008 Emissions	**27,732**	**103,426**	**20,495**	**1,016**	**43,292**	**6,874**				**3,225,354**
Fractional Increase from Sedgwick County Emissions	**0.001**	**0.000**	**0.02**	**0.02**	**0.00000**	**0.0000**				**0.01**
Fractional Increase from Existing McConnell AFB	**0.95**	**0.06**	**1.03**	**0.42**	**0.02**	**0.02**				**0.38**

Table D.4-32. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Acetal-dehyde	*Acrolein*	*Benzene*	*1,3-Butadiene*	*Carbon Disulfide*	*Carbon Tetra-chloride*	*Chloro-form*	*Chloro-methane*	*o-Cresol*	*p-Cresol*
KC-46A Aircraft Operations	2.157	1.237	0.849	0.852	–	–	–	–	–	–
On-Wing Aircraft Engine Testing - KC-46A	0.620	0.356	0.244	0.245	-	-	-	-	-	-
Aerospace Ground Support Equipment - KC-46A	0.044	0.007	0.012	0.001	–	–	–	–	–	–
Transient Aircraft	0.028	0.032	0.051	-	–	–	–	–	–	–
Aerospace Ground Support Equipment - Existing Aircraft	0.059	0.009	0.016	0.001	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.001	–	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**2.909**	**1.641**	**1.173**	**1.099**	**-**	**-**	**-**	**-**	**-**	**-**
Year 2012 Base Case Emissions	**(0.152)**	**(0.051)**	**(0.134)**	**(0.003)**	**-**	**(0.009)**	**(0.052)**	**(0.022)**	**-**	**-**
Proposed Year 2016 minus Base Case Emissions	**2.757**	**1.589**	**1.039**	**1.096**	**-**	**(0.009)**	**(0.052)**	**(0.022)**	**-**	**-**
PSD Thresholds										
Sedgwick County 2008 Emissions										
Fractional Increase from Sedgwick County Emissions										
Fractional Increase from Existing McConnell AFB	**18.13**	**30.93**	**7.77**	**353.47**		**(1.00)**	**(1.00)**	**(1.00)**		

Table D.4-32. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Cumene	*Dibenzo-furan*	*Dibutyl Phthalate*	*1,2-Dichloro-propane*	*2,4-Dinitro-phenol*	*DEHP*	*Ethyl-benzene*	*Formal-dehyde*	*Hexane*	*Methanol*
KC-46A Aircraft Operations	–	–	–	–	–	–	0.088	6.216	–	0.912
On-Wing Aircraft Engine Testing - KC-46A	-	-	-	-	-	-	0.025	1.787	-	0.262
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	–	0.002	0.088	0.001	–
Transient Aircraft	–	–	–	–	–	–	0.005	0.181	–	–
Aerospace Ground Support Equipment - Existing Aircraft	–	–	–	0.002	0.120	0.001	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.000	–	–	–	–	–	0.000	–	0.000	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.000**	**-**	**-**	**0.002**	**0.120**	**0.001**	**0.121**	**8.271**	**0.001**	**1.174**
Year 2012 Base Case Emissions	**(0.000)**	**-**	**-**	**(0.005)**	**(0.249)**	**(0.102)**	**(0.014)**	**(0.914)**	**(0.000)**	**-**
Proposed Year 2016 minus Base Case Emissions	**(0.000)**	**-**	**-**	**(0.003)**	**(0.130)**	**(0.100)**	**0.106**	**7.358**	**0.001**	**1.174**
PSD Thresholds										
Sedgwick County 2008 Emissions										
Fractional Increase from Sedgwick County Emissions										
Fractional Increase from Existing McConnell AFB	**(0.15)**			**(0.52)**	**(0.52)**	**(0.99)**	**7.43**	**8.05**	**12.53**	

Table D.4-32. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year									
	Methylene Chloride	*MIBK*	*MTBE*	*Naphth-alene*	*Phenol*	*POM*	*Propional-dehyde*	*Styrene*	*1,1,2,2-Tetra-chloro-ethane*	*Tetra-chloro-ethene*
KC-46A Aircraft Operations	–	–	–	0.273	0.367	–	–	0.156	–	–
On-Wing Aircraft Engine Testing - KC-46A	-	-	-	0.079	0.105	-	-	0.045	-	-
Aerospace Ground Support Equipment - KC-46A	–	–	–	–	–	0.000	0.006	0.000	–	–
Transient Aircraft	–	–	–	0.015	–	–	–	0.008	–	–
Aerospace Ground Support Equipment - Existing Aircraft	–	0.000	0.008	0.000	–	–	0.012	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	–	–	0.000	0.000	–	–	–	–	–	–
Point and Area Sources	–	–	–	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**-**	**0.000**	**0.008**	**0.368**	**0.472**	**0.000**	**0.018**	**0.209**	**-**	**-**
Year 2012 Base Case Emissions	**(1.315)**	**(0.000)**	**(0.017)**	**(0.032)**	**-**	**-**	**(0.025)**	**(0.016)**	**-**	**(0.048)**
Proposed Year 2016 minus Base Case Emissions	**(1.315)**	**(0.000)**	**(0.009)**	**0.336**	**0.472**	**0.000**	**(0.007)**	**0.194**	**-**	**(0.048)**
PSD Thresholds										
Sedgwick County 2008 Emissions										
Fractional Increase from Sedgwick County Emissions										
Fractional Increase from Existing McConnell AFB	**(1.00)**	**(0.52)**	**(0.51)**	**10.57**			**(0.29)**	**12.42**		**(1.00)**

Table D.4-32. Summary of Total Annual Emissions Associated with the KC-46A MOB 1 Scenario at McConnell AFB – Year 2016 (Continued)

Source Type	Tons per Year						
	Toluene	*1,1,1-Trichloro-ethane*	*Trichloro-ethene*	*2,2,4-Trimethyl-pentane*	*Vinyl Acetate*	*mp-Xylene*	*o-Xylene*
KC-46A Aircraft Operations	0.324	–	–	–	–	0.143	0.084
On-Wing Aircraft Engine Testing - KC-46A	0.093	-	-	-	-	0.041	0.024
Aerospace Ground Support Equipment - KC-46A	0.009	–	–	–	–	–	0.006
Transient Aircraft	0.025	–	–	–	–	–	–
Aerospace Ground Support Equipment - Existing Aircraft	0.008	–	–	–	–	–	–
GMVs/Nonroad Equipment	–	–	–	–	–	–	–
Privately-Owned Vehicles - On-Base	–	–	–	–	–	–	–
Privately-Owned Vehicles - Off-Base	–	–	–	–	–	–	–
Mobile Fuel Transfer Operations	0.001	–	–	0.000	–	–	0.096
Point and Area Sources	–	–	–	–	–	–	–
Total Proposed Emissions - 2016	**0.461**	**-**	**-**	**0.000**	**-**	**0.183**	**0.210**
Year 2012 Base Case Emissions	**(0.168)**	**(0.013)**	**-**	**(0.097)**	**(0.031)**	**-**	**(0.002)**
Proposed Year 2016 minus Base Case Emissions	**0.293**	**(0.013)**	**-**	**(0.097)**	**(0.031)**	**0.183**	**0.208**
PSD Thresholds							
Sedgwick County 2008 Emissions							
Fractional Increase from Sedgwick County Emissions							
Fractional Increase from Existing McConnell AFB	**1.74**	**(1.00)**		**(1.00)**	**(1.00)**		**106.51**

Key: ( ) = parenthesis indicate negative numbers, AFB = Air Force Base, CH_4 = methane, CO = carbon monoxide, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, GMVs = government motor vehicles, NA = not applicable, NO_x = nitrogen oxides, N_2O = nitrous oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, PSD = Prevention of Significant Deterioration, SO_2 = sulfur dioxide, VOC = volatile organic compound.

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APPENDIX E

BUILDINGS KNOWN TO CONTAIN ASBESTOS AND LEAD-BASED PAINT

APPENDIX E BUILDINGS KNOWN TO CONTAIN ASBESTOS, LEAD-BASED PAINT, OR POLYCHLORINATED BIPHENYLS

Appendix E, Tables E-1 through E-6, summarizes the buildings that would be affected by the KC-46A Formal Training Unit (FTU) and First Main Operating Base (MOB 1) beddown-related demolition, renovation, or alteration; their years of construction; and their potential to contain toxic substances (asbestos-containing material [ACM], lead-based paint [LBP], and polychlorinated biphenyls [PCBs]). Tables E-1 and E-2 summarize the project-related toxic substance information for the FTU and MOB 1 scenarios at Altus Air Force Base (AFB). Table E-3 summarizes this information for the MOB 1 mission at Fairchild AFB. Table E-4 summarizes this information for the MOB 1 mission at Grand Forks AFB. Tables E-5 and E-6 summarize this information for the FTU and MOB 1 scenarios at McConnell AFB.

Table E-1. Toxic Substances Associated with Projects for the KC-46A FTU Scenario at Altus AFB

Project	Year Constructed	ACM	LBP	PCBs
Demolition				
Building 170	1972	X	[b]	[c]
Renovation				
Building 87, Group Headquarters and Mission Training	1986	X		[c]
Building 394, Contractor Supply Storage	1955	X	[b]	[c]
Additions/Alterations				
Building 285, Tail Enclosure and Tool Crib Expansion	1956	X	[b]	[c]
Building 193, Squadron Operations/Aircraft Maintenance Unit	1987	X		[c]
Building 518, Tail Enclosure and Fuel Cell Expansion	1971	[a]	[b]	[c]

[a] Building assumed to potentially contain ACM based on construction year of 1987 or older (i.e., year that Building 193, which has been positively identified as having ACM, was constructed).
[b] Building assumed to potentially contain LBP. Although no LBP surveys have been conducted, buildings constructed prior to 1978 may have LBP.
[c] None of the electrical transformers have PCB-containing oil (Wallace 2013).
Key: X = Toxic substance known to occur in the building.

Table E-2. Toxic Substances Associated with Projects for the KC-46A MOB 1 Scenario at Altus AFB

Project	Year Constructed	ACM	LBP	PCBs
Demolition				
Building 82	1955	X	[b]	[c]
Building 171	1984	[a]		[c]
Building 551	1991			[c]
Building 554	1991			[c]
Building 557	1991			[c]
Building 563	1991			[c]
Building 564	1991			[c]
Building 565	1991			[c]
Renovation				
Building 87, Wing Headquarters (Operations Group, Air National Guard, and Air Force Reserve Command)	1986	X		[c]
Building 170, Aircraft Parts Storage/Contractor Supplies	1972	X	[b]	[c]
Building 285, Construct Interior Wall and Expand Hydraulic Shop	1956	X	[b]	[c]
Additions/Alterations				
Building 369, Add Vault	1952	X	[b]	[c]
Building 156, Gym Addition	1956	X	[b]	[c]

[a] Building assumed to potentially contain ACM based on construction year of 1987 or older (i.e., year that Building 193, which has been positively identified as having ACM, was constructed).
[b] Building assumed to potentially contain LBP. Although no LBP surveys have been conducted, buildings constructed prior to 1978 may have LBP.
[c] None of the electrical transformers have PCB-containing oil (Wallace 2013).
Key: X = Toxic substance known to occur in the building.

Table E-3. Toxic Substances Associated with Projects for the KC-46A MOB 1 Mission at Fairchild AFB

Project	Year Constructed	ACM	LBP	PCBs
Demolition				
Building 1011	1958	[a]	[b]	[c]
Building 1013	1958	[a]	[b]	[c]
Building 1015	1958	[a]	[b]	[c]
Building 1017	1955	[a]	[b]	[c]
Building 1018	2001			
Building 1019	1958	[a]	[b]	[c]
Building 2120	1943	[a]	[b]	[c]
Renovation				
Building 1001, Fuselage Trainer	1955	[a]	[b]	[c]
Building 1003, Cargo Deployment Function	1958	[a]	[b]	[c]
Building 1025, Vehicle Servicing	1952	[a]	[b]	[c]
Building 1037, Transitional Wash Rack	1955	[a]	[b]	[c]
Building 2005, Squadron Operations and Aircraft Maintenance Unit	1997			
Building 2007, Squadron Operations and Aircraft Maintenance Unit	1998			
Building 2040, Operations Support Squadron and Aircraft Flight Equipment	1990			
Building 2050, General Maintenance Hangar	1943	X	X	[c]
Building 2090, Aircraft Flight Equipment	2000			
Building 2097, Squadron Operations and Aircraft Maintenance Unit	1998			
Building 2272, Dormitory Conversion	1986			
Building 2245	1943	[a]	[b]	[c]
Additions/Alterations				
Building 2045, Logistics Readiness Squadron	2002			
Building 2048, Weapons System Trainers, Boom Operator Trainers	1943	[a]	[b]	[c]

[a] Building assumed to potentially contain ACM. Thermal system insulation and surfacing material found in buildings constructed no later than 1980 are presumed ACMs (Fairchild AFB 2011a).

[b] Building assumed to potentially contain LBP. An LBP survey is conducted by a contractor prior to any renovation or demolition work at pre-1980 facilities at Fairchild AFB (Fairchild AFB 2011b).

[c] Fluorescent light ballasts in building constructed prior to 1979 that are not labeled PCB-free or are missing date-of-manufacture labels are assumed to contain PCBs and would be removed and handled in accordance with Federal and state regulations and the base Hazardous Waste Management Plan (Fairchild AFB 2011c).

Key: X = Toxic substance known to occur in the building.

Table E-4. Toxic Substances Associated with Projects for the KC-46A MOB 1 Mission at Grand Forks AFB

Project	Year Constructed	ACM	LBP	PCBs
Demolition				
Building 531	1957	[a]	[b]	[c]
Building 635	1973	[a]	[b]	[c]
Renovation				
Building 221, Dormitory	1958	[a]	[b]	[c]
Building 307, Air National Guard Wing Headquarters	1959	[a]	[b]	[c]
Building 528, Base Operations	1957	[a]	[b]	[c]
Building 602, Remotely Piloted Aircraft Wing	1959	[a]	[b]	[c]
Building 607, Operations Group/Operations Support Squadron/Aircraft Maintenance Squadron	1959	[a]	[b]	[c]
Building 629, Squadron Operations/Aircraft Maintenance Unit	1997			[c]
Building 631, Squadron Operations/Aircraft Maintenance Unit	1998			[c]
Building 670, Supply Shop	1990			[c]
Additions/Alterations				
Building 556, Flight Stimulator (Weapons System Trainers, Boom Operator Trainers)	1983			[c]
Building 622, Composite Shop	1961	[a]	[b]	[c]
Building 649, General Maintenance Hangar (3-bay)/Alternate Mission Equipment	1987			[c]
Building 661, Aerospace Ground Equipment	1988			[c]

[a] Buildings constructed before 1980 are assumed to potentially have ACM (thermal system insulation and asphalt and vinyl flooring materials) (AFI 32-1052).
[b] Building is assumed to have LBP. All painted surfaces of buildings constructed before 1980 shall be assumed to contain LBP unless the paint has been tested and determined to be lead-free (Grand Forks AFB 2003).
[c] None of the transformers at Grand Forks AFB have PCB-containing oil (Grand Forks AFB 2009).

Table E-5. Toxic Substances Associated with Projects for the KC-46A FTU Scenario at McConnell AFB

Project	Year Constructed	ACM	LBP	PCBs
Demolition				
Building 977	1977	[a]	[b]	[c]
Building 978	1974	X	[b]	[c]
Building 984	1988	[a]		[c]
Building 985	1987	[a]		[c]
Building 1110	1952	X	[b]	[c]
Building 1122	1958	[a]	[b]	[c]
Renovation				
Building 840, Squadron Operations and Aircrew Flight Equipment	2003			[c]
Additions/Alterations				
Building 1129, Composite Repair Facility	1966	X	[b]	[c]
Building 1170, Director of Maintenance Office	1988	X		[c]

[a] Building assumed to potentially contain ACM, based on construction year of 1988 or older (i.e., year that Building 1170, which has been positively identified as having ACM, was constructed).
[b] Building is assumed to potentially contain LBP. Although no LBP surveys have been conducted, buildings constructed prior to 1978 may have LBP.
[c] None of the electrical transformers have PCB-containing oil (Pettus 2013).
Key: X=Toxic substance known to occur in the building.

Table E-6. Toxic Substances Associated with Projects for the KC-46A MOB 1 Scenario at McConnell AFB

Project	Year Constructed	ACM	LBP	PCBs
Demolition				
Building 973	1970	[a]	[b]	[c]
Building 977	1977	[a]	[b]	[c]
Building 978	1974	X	[b]	[c]
Building 984	1988	[a]		[c]
Building 985	1987	[a]		[c]
Building 1101	1991			[c]
Building 1102	Unknown			
Building 1106	1954	X	[b]	[c]
Building 1110	1952	X	[b]	[c]
Building 1122	1958	[a]	[b]	[c]
Renovation				
Building 1108, Air Transportable Galley/Latrine/Seat Pallet Facility	1966	X	[b]	[c]
Building 1094, 2/3 Weapons System Trainers and 2 Boom Operator Trainers	1988	[a]		[c]
Building 1129, Composite Shop	1966	[a]	[b]	[c]
Building 840, Squadron Operations/Aircrew Flight Equipment	2003			[c]
Building 1183, Squadron Operations/Aircrew Flight Equipment	1998			[c]
Building 1185, Squadron Operations	2001			[c]
Building 1186, Squadron Operations/Aircrew Flight Equipment	1999			[c]
Building 850, Air Force Reserve Command Wing Headquarters	Unknown			
Building 1218, Operations Group Headquarters	1942	[a]	[b]	[c]
Building 1107, Fleet Services	1954	X	[b]	[c]
Building 1166, Interior Modifications for Data and Voice Communications	1976	X	[b]	[c]
Building 1171, Move Aircraft Electrical and Environmental Systems Testing Equipment from Building 1106	1968	X	[b]	[c]
Building 1176, Move Hydraulic Test Stand from Building 1106	1967	[a]	[b]	[c]
Additions/Alterations				
Building 1092, 1 Weapons System Trainer and 1 Boom Operator Trainer	2000			[c]
Building 1220, Mobility Bag Storage Addition	1988	[a]		[c]
Building 852, Maintenance Training Facility	Unknown			

[a] Building assumed to potentially contain ACM based on construction year of 1988 or older (i.e., year that Building 1170, which has been positively identified as having ACM, was constructed).
[b] Building assumed to potentially contain LBP. Although no LBP surveys have been conducted, buildings constructed prior to 1978 may have LBP.
[c] None of the electrical transformers have PCB-containing oil (Pettus 2013).
Key: X=Toxic substance known to occur in the building.

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PUBLIC DOCUMENTS

Air Force Instructions

AFI 32-1052 – Facility Asbestos Management

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