APPENDIX E

Air Emissions Calculation

Holloman AFB, FL
Calculations for QF-4 to QF-16 Transitions

3,000 FT AGL Mixing Height

SOx % EFSOx = 20 * S where EFSOx = SOX emission factor [pounds SOX emitted per thousand pounds of fuel combusted (lb/1000 lb)]
20 = Factor which is derived by converting "weight percent" into units of "lb/1000 lb" and then multiplying times the ratio of the molecular weight of SO2 to the molecular weight of sulfur
S = Weight percent sulfur content of the fuel

SOx% 0.075% Sulfur oxides calculated based on weight percent sulfur content of JP-8 in Petroleum Quality Information System 2009 Annual Report 0.063

SOx Emission Factor EF = 1.5 lb/1000 lb

SOx equation from IERA-RS-BR-SR-2001-0010, Air emissions Inventory Guidance Document for Mobile Sources at Air force Installations (revised December 2003)

JP-8 density = 6.933 lb/gal (based on average, calculated from mean for Region 5 listed in Table 4-9 page 34 in Petroleum Quality Information System 2009 Annual Report
JP-8 HHV= 0.135 MMBtu/gal default HHV from Table D-2 of Federal GHG Accounting and Reporting Guidance Technical Document, CEQ (2010) for kerosene-type jet fuel
72.22 kg CO2/MMBtu emission factor from Table D-2 of Federal GHG Accounting and Reporting Guidance Technical Document, CEQ (2010)
3.100 lb CO2/lb fuel burned

1 kilometer (km) 3,280.84 ft
1 knot= 1.852 km/h
1 knot = 101.2685914 ft/min

Table 1 Inputs to Emissions Calculations (QF-4) J79-GE-15 engine Aircraft has 2 engines

A/B Departure
Flight Profile F4ID

Point	Distance	Height	Speed, kts	Power % ETR
a	0	0	0	100
b	4,000	0	170	100
c	15,000	500	300	95
d	60,000	3,400	350	95

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	4,000	0	85	8,607.83	100	0.464693177	AB	64,446.00	499.1	3100	4.00	9.10	0.01	1.50	0.15	0.14	1,547.36	1.997	4.542	0.005	0.749	0.075	0.070
b-c	11,000	250	235	23,798.12	100	0.462221405	AB	64,446.00	496.5	3100	4.00	9.10	0.01	1.50	0.15	0.14	1,539.13	1.986	4.518	0.005	0.745	0.074	0.070
c-d	45,000	1,950	325	32,912.29	100	1.367270311	Military	17,778.00	405.1	3100	2.20	8.90	0.23	1.50	2.20	1.98	1,255.93	0.891	3.606	0.093	0.608	0.891	0.802
																Emissions in lb for A/B Departure:	**4,342.41**	**4.874**	**12.666**	**0.103**	**2.101**	**1.041**	**0.942**

Military Departure
There are no MIL departure

Point	Distance	Height	Speed, kts	Power % ETR
a	0	0	0	100
b	0	0	170	100
c	0	0	250	100
d	0	0	350	100
DE	0	0	350	100
e	0	0	350	100

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	0	0	85	8,607.83	100	0.000	Military	17,778.00	0.0	3100	2.20	8.90	0.23	1.50	2.20	1.98	0.00	0.000	0.000	0.000	0.000	0.000	0.000
b-c	0	0	210	21,266.40	100	0.000	Military	17,778.00	0.0	3100	2.20	8.90	0.23	1.50	2.20	1.98	0.00	0.000	0.000	0.000	0.000	0.000	0.000
c-d	0	0	300	30,380.58	100	0.000	Military	17,778.00	0.0	3100	2.20	8.90	0.23	1.50	2.20	1.98	0.00	0.000	0.000	0.000	0.000	0.000	0.000
d-DE	0	0	350	35,444.01	100	0.000	Military	17,778.00	0.0	3100	2.20	8.90	0.23	1.50	2.20	1.98	0.00	0.000	0.000	0.000	0.000	0.000	0.000
																Emissions in lb for Military Departure:	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Closed Pattern VFR
Flight Profile F4OC

Point	Distance	Height	Speed, kts	Power % ETR
a	0	50	160	100
b	2,000	0	160	100
c	4,000	0	160	100
d	12,131	500	250	100
e	23,911	2,000	250	85
f	39,042	2,000	250	82
g	50,822	300	170	82
h	53,824	50	160	81.9

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	2,000	25	160	16,202.97	100	0.123	Military	17,778.00	36.6	3100	2.20	8.90	0.23	1.50	2.20	1.98	113.38	0.080	0.326	0.008	0.055	0.080	0.072
b-c	2,000	0	160	16,202.97	100	0.123	Military	17,778.00	36.6	3100	2.20	8.90	0.23	1.50	2.20	1.98	113.38	0.080	0.326	0.008	0.055	0.080	0.072
c-d	8,131	250	205	20,760.06	100	0.392	Approach	6,984.00	45.6	3100	9.40	4.80	1.27	1.50	1.80	1.62	141.33	0.429	0.219	0.058	0.068	0.082	0.074
d-e	11,780	1,250	250	25,317.15	85	0.465	Approach	6,984.00	54.2	3100	9.40	4.80	1.27	1.50	1.80	1.62	167.90	0.509	0.260	0.069	0.081	0.097	0.088
e-f	15,131	2,000	250	25,317.15	82	0.598	Approach	6,984.00	69.6	3100	9.40	4.80	1.27	1.50	1.80	1.62	215.67	0.654	0.334	0.088	0.104	0.125	0.113
f-g	11,780	1,150	210	21,266.40	82	0.554	Approach	6,984.00	64.5	3100	9.40	4.80	1.27	1.50	1.80	1.62	199.89	0.606	0.309	0.082	0.097	0.116	0.104
g-h	3,002	175	165	16,709.32	81.9	0.180	Approach	6,984.00	20.9	3100	9.40	4.80	1.27	1.50	1.80	1.62	64.83	0.197	0.100	0.027	0.031	0.038	0.034
																Emissions in lb for Closed Pattern VFR:	**1016.39**	**2.555**	**1.874**	**0.340**	**0.492**	**0.619**	**0.557**

Closed Pattern IFR
Flight Profile F4LA

Point	Distance	Height	Speed, kts	Power % ETR
a	0	50	160	100
b	4,000	0	160	100
c	12,000	1,000	250	100
CD	59,276	3,000	300	100
d	61,640	3,100	250	85
e	152,032	3,100	250	81.9
EF	151,996	3,000	300	81.9
f	162,032	31,000	250	84
g	176452	2,500	250	85
h	197891	1,500	250	81.9
i	250091	300	160	82
j	256091	50	160	81.9

										Emission Indices, lb/1000 lb											Emissions (lbs)				
segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	NOx	VOC	SO_2	PM10	PM2.5
a-b	4,000	25	160	16,202.97	100	0.246868251	Military	17,778.00	73.1	3100	2.20	8.90	0.23	1.50	2.20	1.98	226.77	0.161	0.651	0.017	0.110	0.161	0.145
b-c	8,000	500	205	20,760.06	100	0.385355318	Military	17,778.00	114.2	3100	2.20	8.90	0.23	1.50	2.20	1.98	353.97	0.251	1.016	0.026	0.171	0.251	0.226
c-CD	47,276	2,000	275	27,848.86	100	1.697598609	Military	17,778.00	503.0	3100	2.20	8.90	0.23	1.50	2.20	1.98	1,559.36	1.107	4.477	0.116	0.754	1.107	0.996
EF-f	10,036	17,000	275	27,848.86	81.9	0.360368121	Intermediate	10,794.00	64.8	3100	4.69	5.60	0.35	1.50	2.80	2.52	200.98	0.304	0.363	0.023	0.097	0.182	0.163
f-g	14,420	16,750	250	25,317.15	84	0.569574428	Intermediate	10,794.00	102.5	3100	4.69	5.60	0.35	1.50	2.80	2.52	317.66	0.481	0.574	0.036	0.154	0.287	0.258
g-h	21,439	2,000	250	25,317.15	85	0.846817348	Intermediate	10,794.00	152.3	3100	4.69	5.60	0.35	1.50	2.80	2.52	472.28	0.714	0.853	0.053	0.229	0.427	0.384
h-i	52,200	900	205	20,760.06	81.9	2.514443449	Intermediate	10,794.00	452.3	3100	4.69	5.60	0.35	1.50	2.80	2.52	1,402.34	2.122	2.533	0.158	0.679	1.267	1.140
i-j	6,000	175	160	16,202.97	82	0.370302376	Intermediate	10,794.00	66.6	3100	4.69	5.60	0.35	1.50	2.80	2.52	206.52	0.312	0.373	0.023	0.100	0.187	0.168
																Emissions in lb for Closed Pattern IFR:	**4,739.88**	**5.452**	**10.840**	**0.452**	**2.293**	**3.867**	**3.480**

Approach
Flight Profile F4BC

Point	Distance	Height	Speed, kts	Power % ETR
a	200,000	12,000	300	81.9
AB	103,304	3,000	300	81.9
b	92,560	2,000	300	85
c	41,562	2,000	300	85
d	35,562	2,000	300	85
e	23,781	2,000	250	85
f	20,781	2,000	200	81.9
g	17,781	2,000	200	81.9
h	6,000	300	190	85
i	0	30	160	81.9

										Emission Indices, lb/1000 lb											Emissions (lbs)				
segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	NOx	VOC	SO_2	PM10	PM2.5
AB-b	10,744	2,500	300	30,380.58	81.9	0.353646998	Intermediate	10,794.00	63.6	3100	4.69	5.60	0.35	1.50	2.80	2.52	197.23	0.298	0.356	0.022	0.095	0.178	0.160
b-c	50,998	2,000	300	30,380.58	85	1.678638272	Intermediate	10,794.00	302.0	3100	4.69	5.60	0.35	1.50	2.80	2.52	936.20	1.416	1.691	0.106	0.453	0.846	0.761
c-d	6,000	2,000	300	30,380.58	85	0.1974946	Intermediate	10,794.00	35.5	3100	4.69	5.60	0.35	1.50	2.80	2.52	110.15	0.167	0.199	0.012	0.053	0.099	0.090
d-e	11,781	2,000	275	27,848.86	85	0.423033434	Intermediate	10,794.00	76.1	3100	4.69	5.60	0.35	1.50	2.80	2.52	235.93	0.357	0.426	0.027	0.114	0.213	0.192
e-f	3,000	2,000	225	22,785.43	85	0.131663067	Intermediate	10,794.00	23.7	3100	4.69	5.60	0.35	1.50	2.80	2.52	73.43	0.111	0.133	0.008	0.036	0.066	0.060
f-g	3,000	2,000	200	20,253.72	91.9	0.14812095	Intermediate	10,794.00	26.6	3100	4.69	5.60	0.35	1.50	2.80	2.52	82.61	0.125	0.149	0.009	0.040	0.075	0.067
g-h	11,781	1,150	195	19,747.38	81.9	0.596585612	Intermediate	10,794.00	107.3	3100	4.69	5.60	0.35	1.50	2.80	2.52	332.72	0.503	0.601	0.038	0.161	0.301	0.270
h-i	6,000	165	175	17,722.00	85	0.338562172	Intermediate	10,794.00	60.9	3100	4.69	5.60	0.35	1.50	2.80	2.52	188.82	0.286	0.341	0.021	0.091	0.171	0.153
																Emissions in lb for Approach:	**2,157.09**	**3.263**	**3.897**	**0.244**	**1.044**	**1.948**	**1.753**

										Emission Indices, lb/1000 lb											Emissions (lbs)				
						Time (min)	Mode	FFR, lb/hr	Fuel Use lb	EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	NOx	VOC	SO_2	PM10	PM2.5
Idle/Taxi						15	Idle	2,222.00	555.5	3100	57.00	2.50	13.80	1.50	0.50	0.45	1,722.12	31.664	1.389	7.666	0.833	0.278	0.250

Table 2. Baseline QF-4 Annual Emissions

Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation							Total Emissions, tons/year						
		CO2	CO	NOx	VOC	SO2	PM10	PM2.5	CO2	CO	NOx	VOC	SO2	PM10	PM2.5
Idle/Taxi out	601	1,722.12	31.66	1.39	7.67	0.83	0.28	0.25	517	9.51	0.42	2.30	0.25	0.08	0.08
After Burner Takeoff	601	4,342.41	4.87	12.67	0.10	2.10	1.04	0.94	1,305	1.46	3.81	0.03	0.63	0.31	0.28
Military Power Takeoffs	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Closed Pattern (VFR)	950	1,016.39	2.56	1.87	0.34	0.49	0.62	0.56	483	1.21	0.89	0.16	0.23	0.29	0.26
Closed Pattern (IFR)	250	4,739.88	5.45	10.84	0.45	2.29	3.87	3.48	592	0.68	1.36	0.06	0.29	0.48	0.44
Approach/Landing	601	2,157.09	3.26	3.90	0.24	1.04	1.95	1.75	648	0.98	1.17	0.07	0.31	0.59	0.53
Taxi in/Idle	601	1,722.12	31.66	1.39	7.67	0.83	0.28	0.25	517	9.51	0.42	2.30	0.25	0.08	0.08
								Tons/year	4,063	23.37	8.06	4.93	1.97	1.84	1.66
								Metric Tons/year	3,686						

Table 3 Inputs to Emissions Calculations (QF-16) F100-PW-220 engine Aircraft has 1 engine

A/B Departure
Flight Profile 16DG

Point	Distance	Height	Speed, kts	Power % ETR
a	0	0	0	92
b	2,700	0	145	92
c	12,000	600	330	92.4
CD	25,051	3,000	340	92.4
d	30,000	3,910	350	87

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	2,700	0	72.5	7,341.97	92	0.367748566	AB	41,682.00	255.5	3100	11.99	8.37	1.53	1.50	1.15	1.04	792.00	3.063	2.138	0.391	0.383	0.294	0.266
b-c	9,300	300	237.5	24,051.29	92	0.386673639	AB	41,682.00	268.6	3100	11.99	8.37	1.53	1.50	1.15	1.04	832.76	3.221	2.248	0.411	0.403	0.309	0.279
c-CD	13,051	1,800	335	33,924.98	92.4	0.384712393	Military	9,679.00	62.1	3100	0.86	29.32	1.79	1.50	1.33	1.20	192.40	0.053	1.820	0.111	0.093	0.083	0.074
																Emissions in lb for A/B Departure:	**1817.16**	**6.337**	**6.206**	**0.913**	**0.879**	**0.685**	**0.620**

Military Departure
Flight Profile 16DF

Point	Distance	Height	Speed, kts	Power % ETR
a	0	0	0	92
b	3,300	0	145	92.4
c	21,000	1,200	300	92.4
CD	43,991	3,000	350	92.4
d	81,160	5,910	350	87

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	3,300	0	72.5	7,341.97	92	0.44947047	AB	41,682.00	312.2	3100	11.99	8.37	1.53	1.50	1.15	1.04	968.01	3.744	2.614	0.478	0.468	0.359	0.325
b-c	17,700	600	222.5	22,532.26	92.4	0.785540321	Military	9,679.00	126.7	3100	0.86	29.32	1.79	1.50	1.33	1.20	392.85	0.109	3.715	0.227	0.190	0.169	0.152
c-CD	22,991	2,100	325	32,912.29	92.4	0.698556109	Military	9,679.00	112.7	3100	0.86	29.32	1.79	1.50	1.33	1.20	349.35	0.097	3.304	0.202	0.169	0.150	0.135
																Emissions in lb for Military Departure:	**1,710.20**	**3.950**	**9.633**	**0.906**	**0.827**	**0.677**	**0.612**

Closed Pattern VFR
Flight Profile 16CG

Point	Distance	Height	Speed, kts	Power % ETR
a	0	50	150	92.6
b	3,000	50	225	92.6
c	10,000	300	270	92.6
d	23,912	2,000	210	80
e	39,043	2,000	170	78
f	47,992	300	150	78
g	53,824	50	150	78

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	3,000	50	187.5	18,987.86	92.6	0.15799568	Military	9,679.00	25.5	3100	0.86	29.32	1.79	1.50	1.33	1.20	79.01	0.022	0.747	0.046	0.038	0.034	0.031
b-c	7,000	175	247.5	25,063.98	92.6	0.279285294	Military	9,679.00	45.1	3100	0.86	29.32	1.79	1.50	1.33	1.20	139.67	0.039	1.321	0.081	0.068	0.060	0.054
c-d	13,912	1,150	240	24,304.46	92.6	0.572405184	Military	9,679.00	92.3	3100	0.86	29.32	1.79	1.50	1.33	1.20	286.26	0.079	2.707	0.165	0.139	0.123	0.111
d-e	15,131	2,000	190	19,241.03	92.6	0.786392316	Military	9,679.00	126.9	3100	0.86	29.32	1.79	1.50	1.33	1.20	393.28	0.109	3.719	0.227	0.190	0.169	0.152
e-f	8,949	1,150	160	16,202.97	80	0.552305994	Intermediate	5,770.00	53.1	3100	0.86	22.18	2.89	1.50	2.06	1.85	164.66	0.046	1.178	0.153	0.080	0.109	0.098
f-g	5,832	175	150	15,190.29	78	0.383929503	Approach	3,837.00	24.6	3100	1.92	12.53	5.12	1.50	2.63	2.37	76.12	0.047	0.308	0.126	0.037	0.065	0.058
																Emissions in lb for Closed Pattern VFR:	**1,139.00**	**0.342**	**9.981**	**0.798**	**0.551**	**0.559**	**0.504**

Closed Pattern IFR
Flight Profile 16CB

Point	Distance	Height	Speed, kts	Power % ETR
a	0	50	150	92.6
b	3,000	50	170	92.6
c	16,655	2,000	250	92.6
d	72,000	2,000	250	80
e	184,796	2,000	250	78
f	215,520	2,000	250	78
g	250,091	300	150	78
h	256,091	50	150	78

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	3,000	50	160	16,202.97	92.6	0.185151188	Military	9,679.00	29.9	3100	0.86	29.32	1.79	1.50	1.33	1.20	92.59	0.026	0.876	0.053	0.045	0.040	0.036
b-c	13,655	1,025	210	21,266.40	92.6	0.642092564	Military	9,679.00	103.6	3100	0.86	29.32	1.79	1.50	1.33	1.20	321.11	0.089	3.037	0.185	0.155	0.138	0.124
c-d	55,345	2,000	250	25,317.15	92.6	2.186067732	Military	9,679.00	352.6	3100	0.86	29.32	1.79	1.50	1.33	1.20	1,093.26	0.303	10.340	0.631	0.529	0.469	0.423
d-e	112,796	2,000	250	25,317.15	80	4.45532019	Intermediate	5,770.00	428.5	3100	0.86	22.18	2.89	1.50	2.06	1.85	1,328.26	0.368	9.503	1.238	0.643	0.883	0.793
e-f	30,724	2,000	250	25,317.15	78	1.213564821	Intermediate	5,770.00	116.7	3100	0.86	22.18	2.89	1.50	2.06	1.85	361.80	0.100	2.589	0.337	0.175	0.240	0.216
e-g	34,571	1,150	200	20,253.72	78	1.706896458	Approach	3,837.00	109.2	3100	1.92	12.53	5.12	1.50	2.63	2.37	338.40	0.210	1.368	0.559	0.164	0.287	0.259
g-h	6,000	175	150	15,190.29	78	0.394989201	Approach	3,837.00	25.3	3100	1.92	12.53	5.12	1.50	2.63	2.37	78.31	0.048	0.317	0.129	0.038	0.066	0.060
																Emissions in lb for Closed Pattern IFR:	**3,613.73**	**1.145**	**28.028**	**3.134**	**1.749**	**2.123**	**1.910**

Approach
Flight Profile 16AD

Point	Distance	Height	Speed, kts	Power % ETR		
a	299,999	12,000	300	80	Variable	Intermediate
b	178,711	4,410	300	80	Variable	Intermediate
BC	92,560	3,000	300	80	Variable	Intermediate
c	71,000	2,500	300	78	Variable	Approach
d	50,000	1,910	250	78	Variable	Approach
e	25,450	1,410	170	78	Variable	Approach
f	7,240	400	150	78	Variable	Approach
g	0	50	150	78	Variable	Approach

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
BC-c	21,560	2,750	300	30,380.58	80	0.709663931	Intermediate	5,770.00	68.2	3100	0.86	22.18	2.89	1.50	2.06	1.85	211.57	0.059	1.514	0.197	0.102	0.141	0.126
c-d	21,000	2,205	275	27,848.86	78	0.754070293	Approach	3,837.00	48.2	3100	1.92	12.53	5.12	1.50	2.63	2.37	149.50	0.093	0.604	0.247	0.072	0.127	0.114
d-e	24,550	1,660	210	21,266.40	78	1.154402962	Approach	3,837.00	73.8	3100	1.92	12.53	5.12	1.50	2.63	2.37	228.86	0.142	0.925	0.378	0.111	0.194	0.175
e-f	18,210	905	160	16,202.97	78	1.123867711	Approach	3,837.00	71.9	3100	1.92	12.53	5.12	1.50	2.63	2.37	222.81	0.138	0.901	0.368	0.108	0.189	0.170
f-g	7,240	225	150	15,190.29	78	0.476620302	Approach	3,837.00	30.5	3100	1.92	12.53	5.12	1.50	2.63	2.37	94.49	0.059	0.382	0.156	0.046	0.080	0.072
																Emissions in lb for Approach:	**907.23**	**0.490**	**4.325**	**1.346**	**0.439**	**0.731**	**0.658**

Simulated Flame Out (SFO)
Flight Profile 16CA

Point	Distance	Height	Speed, kts	Power % ETR
a	0	50	150	92.6
b	3,000	50	170	92.6
c	10,000	200	250	92.6
CD	20,426	3,000	235	92.6
d	38,708	7,910	220	80
e	57,416	7,910	220	55
f	73,124	3,910	220	55
FG	75,447	3,000	220	55
g	78,000	2,000	220	55
h	91832	300	180	55
i	94831	50	180	55

segment	Distance	Height	Speed, kts	speed, ft/min	Power % ETR	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	Emission Indices, lb/1000 lb EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	Emissions (lbs) NOx	VOC	SO_2	PM10	PM2.5
a-b	3,000	50	160	16,202.97	92.6	0.185151188	Military	9,679.00	29.9	3100	0.86	29.32	1.79	1.50	1.33	1.20	92.59	0.026	0.876	0.053	0.045	0.040	0.036
b-c	7,000	125	210	21,266.40	92.6	0.329157667	Military	9,679.00	53.1	3100	0.86	29.32	1.79	1.50	1.33	1.20	164.61	0.046	1.557	0.095	0.080	0.071	0.064
c-CD	10,426	1,600	242.5	24,557.63	92.6	0.42454143	Military	9,679.00	68.5	3100	0.86	29.32	1.79	1.50	1.33	1.20	212.31	0.059	2.008	0.123	0.103	0.091	0.082
FG-g	2,553	2,500	220	22,279.09	55	0.114586348	Approach	3,837.00	7.3	3100	1.92	12.53	5.12	1.50	2.63	2.37	22.72	0.014	0.092	0.038	0.011	0.019	0.017
g-h	13,832	1,150	200	20,253.72	55	0.682936328	Approach	3,837.00	43.7	3100	1.92	12.53	5.12	1.50	2.63	2.37	135.39	0.084	0.547	0.224	0.066	0.115	0.104
h-i	2,999	175	180	18,228.35	55	0.164523974	Approach	3,837.00	10.5	3100	1.92	12.53	5.12	1.50	2.63	2.37	32.62	0.020	0.132	0.054	0.016	0.028	0.025
																Emissions in lb for Simulated Flame Out (SFO):	**660.25**	**0.248**	**5.211**	**0.586**	**0.319**	**0.363**	**0.328**

Idle/Taxi	Time (min)	Mode	FFR, lb/hr	Fuel Use lb	EICO2	EICO	EINOx	EIVOC	EISO2	EIPM10	EIPM2.5	CO_2	CO	NOx	VOC	SO_2	PM10	PM2.5
	15	Idle	1,084.00	271.0	3100	35.30	4.61	7.94	1.50	2.06	1.85	840.13	9.566	1.249	2.152	0.407	0.558	0.501

Table 4. Proposed QF-16 Annual Emissions

[1]Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO2	CO	NOx	VOC	[3]SO2	PM10	PM2.5	Total Emissions, tons/year CO2	CO	NOx	VOC	SO2	PM10	PM2.5
Idle/Taxi out	600	840.13	9.57	1.25	2.15	0.41	0.56	0.50	252	2.87	0.37	0.65	0.12	0.17	0.15
After Burner Takeoff	54	1,817.16	6.34	6.21	0.91	0.88	0.69	0.62	49	0.17	0.17	0.02	0.02	0.02	0.02
Military Power Takeoffs	546	1,710.20	3.95	9.63	0.91	0.83	0.68	0.61	467	1.08	2.63	0.25	0.23	0.18	0.17
Closed Pattern (VFR)	733	1,139.00	0.34	9.98	0.80	0.55	0.56	0.50	417	0.13	3.66	0.29	0.20	0.20	0.18
Closed Pattern (IFR)	275	3,613.73	1.14	28.03	3.13	1.75	2.12	1.91	497	0.16	3.85	0.43	0.24	0.29	0.26
Approach/Landing	600	907.23	0.49	4.33	1.35	0.44	0.73	0.66	272	0.15	1.30	0.40	0.13	0.22	0.20
Simulated Flame Out	192	660.25	0.25	5.21	0.59	0.32	0.36	0.33	63	0.02	0.50	0.06	0.03	0.03	0.03
Taxi in/Idle	600	840.13	9.57	1.25	2.15	0.41	0.56	0.50	252	2.87	0.37	0.65	0.12	0.17	0.15
								Tons/year	2,270	7.44	12.86	2.75	1.10	1.29	1.16
								Metric Tons/year	2,059						

Table 5. Net Change from QF-4 to QF-16

Type	CO2 Metric tons/year	CO tons/year	NOx tons/year	VOC tons/year	SO2 tons/year	PM10 tons/year	PM2.5 tons/year
QF-4	3,686	23.37	8.06	4.93	1.97	1.84	1.66
QF-16	2,059	7.44	12.86	2.75	1.10	1.29	1.16
Net Change	**-1,627**	**-16**	**5**	**-2**	**-0.9**	**-0.6**	**-0.5**