
B

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TABLE B.1 EMISSION FACTORS FOR OPERATIONS OF F/A-18G AIRCRAFT

Flight Operation and Flight Mode		Engine Power Setting ¹	No. of Engines in Use	Time-in-Mode per Engine (min)	Fuel Flow Rate per Engine (lb/hr)	Fuel Used (lbs)	Engine(s): F414-GE500 (2)					APU Type: GTC 36-200						
							Emission Indexes (pounds per 1,000 pounds fuel)					Emissions from Single Landing and Take Off (lb/operations)						
							EI CO	EI NO _x	EI HC	EI SO ₂	EI PM ₁₀	CO	NO _x	HC	SO ₂	PM ₁₀		
Departure																		
APU Use	ON	1	5.0	197	16.42	2.00	6.25	0.25	0.40	0.22	0.033	0.103	0.004	0.007	0.004			
Start/Warm-up	G Idle	2	15.0	723	361.50	93.26	3.23	59.39	0.40	13.39	33.713	1.168	21.469	0.145	4.840			
Unstick	75% N2	2	0.3	1,421	14.21	26.09	4.85	5.37	0.40	10.49	0.371	0.069	0.076	0.006	0.149			
Taxi Out	G Idle	2	5.0	723	120.50	93.26	3.23	59.39	0.40	13.39	11.238	0.389	7.156	0.048	1.613			
Engine Run-up	80% N2	2	0.5	2,337	38.95	5.34	7.08	0.34	0.40	8.47	0.208	0.276	0.013	0.016	0.330			
Takeoff	Max AB	2	0.5	35,763	596.05	274.97	9.67	4.87	0.40	No Data	163.896	5.764	2.903	0.238	0.000			
Takeoff - No A/B	95% N2	2	0.5	9,225	153.75	0.69	28.11	0.12	0.40	3.14	0.106	4.322	0.018	0.062	0.483			
Climbout	95% N2	2	1.0	9,225	307.50	0.69	28.11	0.12	0.40	3.14	0.212	8.644	0.037	0.123	0.966			
Single Departure Totals						1455.1					209.67	16.41	31.66	0.58	7.90			
Single Departure Totals, no AB						1012.8					45.88	14.97	28.77	0.41	8.38			
Arrival straight in																		
Approach	85% N2	2	3.0	4,049	404.90	0.89	11.58	0.12	0.4	6.31	0.360	4.689	0.049	0.162	2.555			
On Runway(WOW)	G Idle	2	1.0	723	24.10	93.26	3.23	59.39	0.4	13.39	2.248	0.078	1.431	0.010	0.323			
Unstick	75% N2	2	0.3	1,421	14.21	26.09	4.85	5.37	0.4	10.49	0.371	0.069	0.076	0.006	0.149			
Taxi In/ shut down	G Idle	2	8.0	723	192.80	93.26	3.23	59.39	0.4	13.39	17.981	0.623	11.450	0.077	2.582			
Hot Refuel	G Idle	2	15.0	723	361.50	93.26	3.23	59.39	0.4	13.39	33.713	1.168	21.469	0.145	4.840			
Single Straight in Arrival Totals						997.5					54.67	6.63	34.48	0.40	10.45			
Single Straight in Arrival Totals, no hotfuel						636.0					20.96	5.46	13.01	0.25	5.61			
Arrival /w break																		
Approach to break	90% N2	2	1.0	6,505	216.8	0.70	18.82	0.12	0.40	4.48	0.152	4.081	0.026	0.087	0.971			
Break	F Idle	2	0.5	880	14.7	69.91	3.59	34.50	0.40	12.52	1.025	0.053	0.506	0.006	0.184			
Circle	80% N2	2	1.0	2,337	77.9	5.34	7.08	0.34	0.40	8.47	0.416	0.552	0.026	0.031	0.660			
Approach	80% N2	2	0.5	2,337	39.0	5.34	7.08	0.34	0.40	8.47	0.208	0.276	0.013	0.016	0.330			
On Runway(WOW)	G Idle	2	1.0	723	24.1	93.26	3.23	59.39	0.40	13.39	2.248	0.078	1.431	0.010	0.323			
Unstick	75% N2	2	0.3	1,421	14.2	26.09	4.85	5.37	0.40	10.49	0.371	0.069	0.076	0.006	0.149			
Taxi In	G Idle	2	8.0	723	192.8	93.26	3.23	59.39	0.40	13.39	17.981	0.623	11.450	0.077	2.582			
Hot Refuel	G Idle	2	15.0	723	361.5	93.26	3.23	59.39	0.40	13.39	33.713	1.168	21.469	0.145	4.840			
Single Arrival with Break w/ hot refuel						941.0					56.11	6.90	35.00	0.38	10.04			
Single Arrival with Break w/o hot refuel						579.5					22.40	5.73	13.53	0.23	5.20			
Single F/A-18E/F LTO with Straight In Arrival, w/ hot refuel, w/AB						2,453					264.34	23.04	66.14	0.98	18.35			
Single F/A-18E/F LTO with Straight In Arrival, w/o hot refuel, w/ AB						2,091					230.63	21.87	44.67	0.84	13.51			
Single F/A-18E/F LTO with Straight In Arrival, w/ hot refuel, w/o AB						2,010					100.55	21.60	63.25	0.80	18.83			
Single F/A-18E/F LTO with Straight In Arrival, w/o hot refuel, w/o AB						1,649					66.84	20.43	41.78	0.66	13.99			
Single F/A-18E/F LTO with Break Arrival, w/ hot refuel, w/AB						2,396					265.78	23.31	66.66	0.96	17.94			
Single F/A-18E/F LTO with Break Arrival, w/o hot refuel, w/ AB						2,035					232.07	22.14	45.19	0.81	13.10			
Single F/A-18E/F LTO with Break Arrival, w/ hot refuel, w/o AB						1,954					101.99	21.87	63.77	0.78	18.42			
Single F/A-18E/F LTO with Break Arrival, w/o hot refuel, w/o AB						1,592					68.28	20.70	42.30	0.64	13.58			
Data source: AESO Memorandum Report No. 9815, Revision E, Nov 2002																		
Touch-and Go (T&G) and Field Carrier Landing Practice (FCLP)																		
Approach	85% N2	2	1.0	4,049	134.97	0.89	11.58	0.12	0.40	6.31	0.120	1.563	0.016	0.054	0.852			
Climbout	95% N2	2	0.5	9,225	153.75	0.69	28.11	0.12	0.40	3.14	0.106	4.322	0.018	0.062	0.483			
Circle	85% N2	2	2.0	4,049	269.93	0.89	11.58	0.12	0.40	6.31	0.240	3.126	0.032	0.108	1.703			
Single Touch-and Go or Field Carrier Landing Practice Total						558.65					0.47	9.01	0.07	0.22	3.04			
Ground Control Approach (GCA) Box																		
Approach	85% N2	2	1.0	4,049	134.97	0.89	11.58	0.12	0.40	6.31	0.120	1.563	0.016	0.054	0.852			
Climbout	95% N2	2	1.0	9,225	307.50	0.69	28.11	0.12	0.40	3.14	0.212	8.644	0.037	0.123	0.966			
Circle	85% N2	2	5.0	4,049	674.83	0.89	11.58	0.12	0.40	6.31	0.601	7.815	0.081	0.270	4.258			
Single Ground Control Approach Total						1,117.30					0.93	18.02	0.13	0.45	6.08			

Data source: AESO Memorandum Report No. 9933B, Nov 2002

TABLE B.2 EMISSIONS FACTORS FOR OPERATIONS OF EA-6B AIRCRAFT

Flight Operation and Flight Mode							Engine(s): J52-P-408A (2)					APU Type: None				
							Emission Indexes ² (pounds per 1,000 pounds fuel)					Emissions from Single Landing and Take Off ⁴ (lb/Operation)				
Engine Power Setting ¹	No. of Engines in Use ¹	Time-in-Mode per Engine ¹ (min)	Fuel Flow Rate per Engine ² (lb/hr)	Fuel Used ³ (lbs)	EI CO	EI NO _x	EI HC	EI SO ₂	EI PM ₁₀	CO	NO _x	HC	SO ₂	PM ₁₀		
Landing and Take Off (LTO) Operations with Straight-in Arrival																
Departure																
Start/Warm-up	Idle	2	15.0	779	389.50	55.96	2.38	28.33	0.40	19.94	21.80	0.93	11.03	0.16	7.77	
Unstick	70% N2	2	0.3	1,825	18.25	18.09	4.30	2.40	0.40	15.41	0.33	0.08	0.04	0.01	0.28	
Taxi Out	Idle	2	5.0	779	129.83	55.96	2.38	28.33	0.40	19.94	7.27	0.31	3.68	0.05	2.59	
Engine Run-up	85% N2	2	0.5	4,227	70.45	5.19	6.77	0.84	0.40	10.48	0.37	0.48	0.06	0.03	0.74	
Takeoff	95% N2	2	0.5	7,401	123.35	2.10	10.05	0.60	0.40	7.18	0.26	1.24	0.07	0.05	0.89	
Climbout	95% N2	2	1.0	7,401	246.70	2.10	10.05	0.60	0.40	7.18	0.52	2.48	0.15	0.10	1.77	
Single Departure Totals					978.08						30.53	5.51	15.04	0.39	14.03	
Arrival straight in																
Approach	85% N2	2	5.0	4,227	704.50	5.19	6.77	0.84	0.40	10.48	3.66	4.77	0.59	0.28	7.38	
On runway (WoW)	Idle	2	1.0	779	25.97	55.96	2.38	28.33	0.40	19.94	1.45	0.06	0.74	0.01	0.52	
Unstick	70% N2	2	0.3	1,825	18.25	18.09	4.30	2.40	0.40	15.41	0.33	0.08	0.04	0.01	0.28	
Taxi In/Shut down	Idle	2	10.0	779	259.67	55.96	2.38	28.33	0.40	19.94	14.53	0.62	7.36	0.10	5.18	
Hot Refuel ¹	Idle	1	20.0	779	259.67	55.96	2.38	28.33	0.40	19.94	14.53	0.62	7.36	0.10	5.18	
Single Straight In Arrival Totals					1268.05						34.50	6.15	16.08	0.51	18.54	
Single Straight In Arrival Totals, no hot refuel					1008.38						19.97	5.53	8.73	0.40	13.36	
Single EA-6B LTO with Straight in Arrival					2246.13						65.04	11.66	31.12	0.90	32.57	
Single EA-6B LTO with Straight in Arrival, no hot refuel					1986.47						50.51	11.04	23.77	0.79	27.39	
Landing and Take Off (LTO) Operations with Break Arrival																
Departure																
Start/Warm-up	Idle	2	15.0	779	389.50	55.96	2.38	28.33	0.40	19.94	21.80	0.93	11.03	0.16	7.77	
Unstick	70% N2	2	0.3	1,825	18.25	18.09	4.30	2.40	0.40	15.41	0.33	0.08	0.04	0.01	0.28	
Taxi Out	Idle	2	5.0	779	129.83	55.96	2.38	28.33	0.40	19.94	7.27	0.31	3.68	0.05	2.59	
Engine Run-up	85% N2	2	0.5	4,227	70.45	5.19	6.77	0.84	0.40	10.48	0.37	0.48	0.06	0.03	0.74	
Takeoff	95% N2	2	0.5	7,401	123.35	2.10	10.05	0.60	0.40	7.18	0.26	1.24	0.07	0.05	0.89	
Climbout	95% N2	2	1.0	7,401	246.70	2.10	10.05	0.60	0.40	7.18	0.52	2.48	0.15	0.10	1.77	
Single Departure Totals					978.08						30.53	5.51	15.04	0.39	14.03	
Arrival w/ break																
Approach to break	90% N2	2	2.0	5,594	372.93	3.33	8.18	0.70	0.40	8.83	1.24	3.05	0.26	0.15	3.29	
Break	60% N2	2	0.5	1,042	17.37	38.61	3.49	9.54	0.40	18.70	0.67	0.06	0.17	0.01	0.32	
Circle	80% N2	2	1.0	3,195	106.50	7.99	5.71	1.09	0.40	12.12	0.85	0.61	0.12	0.04	1.29	
Approach	85% N2	2	1.0	4,227	140.90	5.19	6.77	0.84	0.40	10.48	0.73	0.95	0.12	0.06	1.48	
On runway (WoW)	Idle	2	1.0	779	25.97	55.96	2.38	28.33	0.40	19.94	1.45	0.06	0.74	0.01	0.52	
Unstick	70% N2	2	0.3	1,825	18.25	18.09	4.30	2.40	0.40	15.41	0.33	0.08	0.04	0.01	0.28	
Taxi In/Shut down	Idle	2	10.0	779	259.67	55.96	2.38	28.33	0.40	19.94	14.53	0.62	7.36	0.10	5.18	
Hot Refuel ¹	Idle	1	20.0	779	259.67	55.96	2.38	28.33	0.40	19.94	14.53	0.62	7.36	0.10	5.18	
Single Arrival w/ Break Totals					1201.25						34.34	6.05	16.15	0.48	17.54	
Single Arrival w/ Break, no hot refuel Totals					941.58						19.81	5.43	8.80	0.38	12.36	
Single EA-6B LTO with Break at Arrival					2179.33						64.87	11.56	31.19	0.87	31.57	
Single EA-6B LTO with Break Arrival, no hot refuel					1919.67						50.34	10.94	23.83	0.77	26.39	
Touch-and Go (T&G) and Field Carrier Landing Practice (FCLP)																
Approach	85% N2	2	1	4,227	140.90	5.19	6.77	0.84	0.4	10.48	0.73	0.95	0.12	0.06	1.48	
Climbout	95% N2	2	1	7,401	246.70	2.1	10.05	0.6	0.4	7.18	0.52	2.48	0.15	0.10	1.77	
Circle	80% N2	2	2	3,195	213.00	7.99	5.71	1.09	0.4	12.12	1.70	1.22	0.23	0.09	2.58	
Single Touch-and Go or Field Carrier Landing Practice Total					600.60						2.95	4.65	0.50	0.24	5.83	
Ground Control Approach (GCA) Box																
Approach	85% N2	2	2	4,227	281.80	5.19	6.77	0.84	0.4	10.48	1.46	1.91	0.24	0.11	2.95	
Climbout	95% N2	2	1	7,401	246.70	2.1	10.05	0.6	0.4	7.18	0.52	2.48	0.15	0.10	1.77	
Circle	80% N2	2	5	3,195	532.50	7.99	5.71	1.09	0.4	12.12	4.25	3.04	0.58	0.21	6.45	
Single Ground Control Approach Total					1061.00						6.24	7.43	0.97	0.42	11.18	

¹Time in Mode Source: CDR Miller, NAS Oceana, 1997

Data source: AESO Memorandum Report No. 9917, Revision B, Aug 2002

Data source: AESO Memorandum Report No. 9941A, August 2002

TABLE B.3 MODAL EMISSION RATES FOR OTHER AIRCRAFT AT NAS WHIDBEY ISLAND

Aircraft (Engine Model)	Engine Mode	Engine Power Setting	Time in Mode (minutes)	Fuel Flow ((lb/hr)/eng)	Fuel Flow ((lb/min)/eng)	Engines	VOC	Emission Index (lb /1000 lb fuel)					Modal Emission Rates (lb/mode)			
								NOx	CO	SO2	PM10	VOC (1)	NOx	CO	SO2	PM10 (2)
P-3 (T56-A-14) APU type: GTCP 95-2/3	APU	100%	120.0	293	4.88	1	0.42	5.65	3.20	0.40	0.22	0.25	3.31	1.88	0.23	0.13
	Start/Warm up	L/S Idle	9.0	599	9.98	3	22.32	3.53	30.11	0.40	3.97	6.02	0.95	8.12	0.11	1.07
	Start/Warm up	H/S Idle	13.0	756	12.60	1	1.42	6.35	5.65	0.40	3.97	0.23	1.04	0.93	0.07	0.65
	Unstick	24% shp	0.2	1000	16.67	4	0.61	7.61	2.65	0.40	3.97	0.01	0.10	0.04	0.01	0.05
	Taxi Out/Idle	L/S Idle	10.0	599	9.98	3	22.32	3.53	30.11	0.40	3.97	6.68	1.06	9.02	0.12	1.19
	Taxi Out/Idle	H/S Idle	10.0	756	12.60	1	1.42	6.35	5.65	0.40	3.97	0.18	0.80	0.71	0.05	0.50
	Run up	Military	0.3	2219.0	36.98	4	0.16	10.45	0.65	0.40	3.97	0.01	0.46	0.03	0.02	0.18
	Take Off	Military	0.5	2219.0	36.98	4	0.16	10.45	0.65	0.40	3.97	0.01	0.77	0.05	0.03	0.29
	Climbout	74% shp	3.0	1800.0	30.00	4	0.21	9.83	0.94	0.40	3.97	0.08	3.54	0.34	0.14	1.43
	Approach	37% shp	10.0	1200.0	20.00	4	0.41	8.43	1.82	0.40	3.97	0.33	6.74	1.46	0.32	3.18
	On Runway	H/S Idle	1.0	756	12.60	4	1.42	6.35	5.65	0.40	3.97	0.07	0.32	0.28	0.02	0.20
	Taxi In/Idle	L/S Idle	12.0	599	9.98	4	22.32	3.53	30.11	0.40	3.97	10.70	1.69	14.43	0.19	1.90
	APU	100%	15.0	293	4.88	1	0.42	5.65	3.20	0.40	0.22	0.03	0.41	0.23	0.03	0.02
	T&G Level ^{1,2}	37% shp	2.0	1200.0	20.00	4	0.41	8.43	1.82	0.40	3.97	0.07	1.35	0.29	0.06	0.64
	GCA Box ¹	37% shp	5.0	1200.0	20.00	4	0.41	8.43	1.82	0.40	3.97	0.16	3.37	0.73	0.16	1.59
	Full LTO											24.59	21.21	37.50	1.34	10.79
Touch and Go ³											0.47	1.75	0.69	0.47	1.04	
GCA Box ³											0.57	3.78	1.13	0.56	1.99	
Data source: AESO Memorandum Report 9911B April 2000																
C-12/TC-4 (PT6A-41)	Start/Warm up	G Idle	10.00	138.0	2.30	2	8.98	3.05	29.78	0.40	4.20	0.41	0.14	1.37	0.02	0.19
	Unstick	71.2%	0.25	161.0	2.68	2	3.92	3.26	23.12	0.40	4.20	0.01	0.00	0.03	0.00	0.01
	Taxi Out/Idle	63.2%	5.00	148.0	2.47	2	6.21	3.13	28.36	0.40	4.20	0.15	0.08	0.70	0.01	0.10
	Run up	93.8%	0.50	401.0	6.68	2	0.11	6.53	0.76	0.40	4.20	0.00	0.04	0.01	0.00	0.03
	Take Off	100.0%	0.50	540.0	9.00	2	0.11	8.32	0.75	0.40	4.20	0.00	0.07	0.01	0.00	0.04
	Climbout	100.0%	2.00	540.0	9.00	2	0.11	8.32	0.75	0.40	4.20	0.00	0.30	0.03	0.01	0.15
	Approach	86.7%	5.00	249.0	4.15	2	0.23	4.42	4.93	0.40	4.20	0.01	0.18	0.20	0.02	0.17
	On Runway	63.2%	1.00	148.0	2.47	2	6.21	3.13	28.36	0.40	4.20	0.03	0.02	0.14	0.00	0.02
	Unstick	71.2%	0.25	161.0	2.68	2	3.92	3.26	23.12	0.40	4.20	0.01	0.00	0.03	0.00	0.01
	Taxi In/Idle	63.2%	5.00	148.0	2.47	2	6.21	3.13	28.36	0.40	4.20	0.15	0.08	0.70	0.01	0.10
	Shut down	G Idle	1.00	138.0	2.30	2	8.98	3.05	29.78	0.40	4.20	0.04	0.01	0.14	0.00	0.02
	T&G Level	varies	4.00	varies	varies	2	varies	varies	varies	0.40	4.20	0.01	0.39	0.09	0.04	0.39
	GCA Box	varies	8.00	varies	varies	2	varies	varies	varies	0.40	4.20	0.01	0.56	0.15	0.04	0.39
	Touch and Go											0.02	0.87	0.32	0.07	0.72
Full LTO											0.82	0.93	3.35	0.08	0.84	
GCA Box											0.01	0.56	0.15	0.04	0.39	
Data source: AESO Memorandum Report 9910 Revision B April 2000 and 9935 Revision A March 2000																
C-9 (JT8D-9) APU: GTCP-85	APU Use	On	1	75	293	366	0.42	5.65	3.20	0.40	0.22	0.154	2.069	1.172	0.147	0.081
	Start/Warm	Idle	2	5	1,049	175	10.00	2.90	34.50	0.40	19.59	1.748	0.507	6.029	0.070	3.424
	Unstick	70% rpm	2	0.25	2,368	20	1.72	5.46	9.36	0.40	16.25	0.034	0.108	0.185	0.008	0.321
	Taxi Out	Idle	2	7	1,049	245	10.00	2.90	34.50	0.40	19.59	2.447	0.710	8.441	0.098	4.793
	Run-up	80% rpm	2	0.5	3,547	59	0.67	7.79	4.90	0.40	14.59	0.040	0.461	0.290	0.024	0.863
	Takeoff	Military	2	1	8,254	275	0.47	17.92	1.24	0.40	11.12	0.129	4.931	0.341	0.110	3.060
	Climbout	90% rpm	2	1.5	5,387	269	0.48	11.59	2.51	0.40	12.87	0.129	3.122	0.676	0.108	3.466
	Approach	80% rpm	2	5	3,547	591	0.67	7.79	4.90	0.40	14.59	0.396	4.606	2.897	0.236	8.626
	On runway	70% rpm	2	1	2,368	79	1.72	5.46	9.36	0.40	16.25	0.136	0.431	0.739	0.032	1.283
	Unstick	70% rpm	2	0.25	2,368	20	1.72	5.46	9.36	0.40	16.25	0.034	0.108	0.185	0.008	0.321
	Taxi in	Idle	2	10	1,049	350	10.00	2.90	34.50	0.40	19.59	3.495	1.014	12.059	0.140	6.847
	APU Use	On	1	20	293	98	0.42	5.65	3.20	0.40	0.22	0.041	0.552	0.313	0.039	0.021
	Full LTO											8.78	18.62	33.33	1.02	33.10
Data source: AESO Memorandum Report 9926 C-9 LTO and Maintenance Emissions Estimates																

¹ Time in mode (TIM) for level modes were estimated from flight track profiles for EA-6B aircraft, assuming a power setting of 37% shp.

² FCLP Emission Factors are the same as T&G

³ Emission rates for T&G and GCA Box operations include approach, climbout, and level modes only.

Key: VOC = volatile organic compounds
 NOx = oxides of nitrogen
 CO = carbon monoxide
 SO2 = sulfur dioxide
 PM10 = particulate matter
 LTO = Landing and Take Off Cycle
 T&G = touch and go

TABLE B.4 PROJECTED EMISSIONS FROM IN-FRAME MAINTENANCE RUN UP OPERATIONS OF EA-18G AIRCRAFT

Maintenance Operation and Engine Mode	Engine Power Setting ¹	Maint. Test per yr ¹	No. of Engines in Use ¹	Time-in-Mode per Engine ¹ (min)	Fuel Flow Rate per Engine ^{2,3} (lb/hr)	Fuel Used ⁴ (lbs/AC/yr)	Engine(s): F414-GE-400 (2)					APU Type: GTC 36-200				
							Emission Indexes ^{2,3} (pounds per 1,000 pounds fuel)					Emissions from Maint. Test per Year ² (lb /yr)				
							EI CO	EI NO _x	EI HC	EI SO ₂	EI PM ₁₀	CO	NO _x	HC	SO ₂	PM ₁₀
APU Check																
APU Use	On	52	1	10	197	1,707	2.00	6.25	0.25	0.40	0.22	3.4	10.7	0.4	0.7	0.4
APU Check Totals						1,707						3.4	10.7	0.4	0.7	0.4
Water Wash																
APU Use	On	57	1	5	197	936	2.00	6.25	0.25	0.40	0.22	1.9	5.8	0.2	0.4	0.2
Main eng run	Gr Idle	57	1	10	723	6,869	93.26	3.29	54.20	0.40	12.75	640.6	22.6	372.3	2.7	87.6
Water Wash Totals						7,804						642.4	28.4	372.5	3.1	87.8
Low Power- 2 Engines																
APU Use	On	701	1	5	197	11,508	2.00	6.25	0.25	0.40	0.22	23.0	71.9	2.9	4.6	2.5
Main eng run	Gr Idle (56%)	701	2	15	723	253,412	93.26	3.29	54.20	0.40	12.75	23,633.2	833.7	13,734.9	101.4	3,231.0
	80%	701	2	15	2,337	819,287	5.34	7.08	0.34	0.40	8.47	4,375.0	5,800.6	278.6	327.7	6,939.4
Low Power- Two Engine Totals						1,084,206						28,031.2	6,706.2	14,016.3	433.7	10,172.9
High Power																
APU Use	On	34	1	5	197	558	2.00	6.25	0.25	0.40	0.22	1.1	3.5	0.1	0.2	0.1
Main eng run	Gr. Idle	34	2	10	723	8,194	93.26	3.29	54.20	0.40	12.75	764.2	27.0	444.1	3.3	104.5
Main eng run	80%	34	2	10	2,337	26,491	5.34	7.08	0.34	0.40	8.47	141.5	187.6	9.0	10.6	224.4
Main eng run	90%	34	2	10	6,505	73,724	0.70	18.82	0.12	0.40	4.48	51.6	1,387.5	8.8	29.5	330.3
Main eng run	MIL 96%	34	2	10	9,941	112,666	0.69	30.81	0.12	0.40	2.86	77.7	3,471.2	13.5	45.1	322.2
Main eng run	AB 97%	34	2	3	35,763	121,594	274.97	9.67	4.87	0.40	0.00	33,434.8	1,175.8	592.2	48.6	-
High Power Totals						343,228						34,470.9	6,252.6	1,067.8	137.3	981.5
Total Annual Maintenance Test Emissions From F/A-18G Aircraft (pounds)											63,147.9	12,997.9	15,457.1	574.8	11,242.5	
Total Annual Maintenance Test Emissions From F/A-18G Aircraft (Tons)											31.57	6.50	7.73	0.29	5.62	

Notes:

¹ Total maintenance tests from Wyle Laboratories, 2004 (see table A.3).

² Fuel flow and emission indexes from AESO memorandum report 9725B (Nov 2002).

³ Fuel used = fuel flow x time-in-mode / 60/ x no. of engines in use x maintenance tests per aircraft year.

⁴ Emissions = fuel used / 1000 x emission index

TABLE B.5 EXISTING EMISSIONS FROM IN-FRAME MAINTENANCE RUN UP OPERATIONS OF EA-6B AIRCRAFT

Maintenance Operation and Engine Mode	Engine Power Setting ¹	Maint. Test per yr ¹	No. of Engines in Use ¹	Time-in-Mode per Engine ¹ (min)	Fuel Flow Rate per Engine ² (lb/hr)	Fuel Used ³ (lbs/yr)	Engine(s): J52-P- 408A (2) Emission Indexes ² (pounds per 1,000 pounds fuel)					APU Type: None Emissions from Maint. Test per Year ⁴ (lb/yr)				
							EI CO	EI NOx	EI HC	EI SO2	EI PM10	CO	NOx	HC	SO2	PM10
Water Wash- see Low Power- 2 Engines																
Low Power- 1 Engine																
Main eng run	Idle	2592	1	15	779.0	504,792	55.96	2.38	28.33	0.40	19.94	28248.16	1201.40	14300.76	201.92	10065.55
Main eng run	75% N2	2592	1	5	2,415.0	521,640	12.11	4.91	1.53	0.40	13.77	6317.06	2561.25	798.11	208.66	7182.98
Low Power- One Engine Totals						1,026,432						34,565.22	3,762.66	15,098.87	410.57	17,248.54
Low Power- 2 Engines																
Main eng run	Idle	1080	2	25	779.0	701,100	55.96	2.38	28.33	0.40	19.94	39233.56	1668.62	19862.16	280.44	13979.93
Main eng run	75% N2	1080	2	8	2,415.0	695,520	12.11	4.91	1.53	0.40	13.77	8422.75	3415.00	1064.15	278.21	9577.31
Low Power- Two Engine Totals						1,396,620						47,656.30	5,083.62	20,926.31	558.65	23,557.24
High Power																
engine start/taxi	Idle	360	2	16	779.0	149,568	55.96	2.38	28.33	0.40	19.94	8369.83	355.97	4237.26	59.83	2982.39
Intermed power	70% N2	360	2	15	1,825.0	328,500	18.09	4.30	2.40	0.40	15.41	5942.57	1412.55	788.40	131.40	5062.19
High power	98% N2	360	2	10	8,755.0	1,050,600	1.58	11.44	0.56	0.40	6.20	1659.95	12018.86	588.34	420.24	6513.72
High Power Totals						1,528,668						15,972.34	13,787.39	5,614.00	611.47	14,558.29
Total Annual Emissions from EA-6B In Frame Maintenance Testing (lbs)						3,951,720						98,193.86	22,633.66	41,639.17	1,580.69	55,364.07
Total Annual Emissions from EA-6B In Frame Maintenance Testing (tons)						1,976						49.10	11.32	20.82	0.79	27.68

EA-6B Notes:

¹ Total maintenance tests from Wyle Laboratories, 2004 (see table A.3).

² No data available for the J52-P-408A engine. Fuel flow and emission indexes are for the J52-P-408 from: *J52-P-408 Engine Fuel Flow and Emission Indexes by Percentage of Core RPM (%N2)* –DRAFT–; Aircraft Environmental Support Office; San Diego, CA., January 1999; AESO Memorandum Report

³ Fuel used = fuel flow x time-in-mode / 60 x no. of engines in use x maint. test per AC per yr.

⁴ Emissions = fuel used / 1,000 x emission index

TABLE B.6 ESTIMATED EMISSIONS FROM IN-FRAME MAINTENANCE RUN UP OPERATIONS OF P-3 AIRCRAFT

Maintenance Operation and Engine Mode	Engine Power Setting ¹	Maint. Test per yr ¹	No. of Engines in Use ¹	Mode per Time-in-Engine ¹ (min)	Fuel Flow Rate per Engine ^{2,3} (lb/hr)	Fuel Used ⁴ (lbs/yr)	Engine(s): T56-A-14 (4)					APU Type: GTCP 95-2/3				
							Emission Indexes ^{2,3} (pounds per 1,000 pounds fuel)					Emissions from Maint. Test per Year ⁵ (lb /yr)				
							EI CO	EI NO _x	EI HC	EI SO ₂	EI PM ₁₀	CO	NO _x	HC	SO ₂	PM ₁₀
APU Check																
APU Use	On	210	1	30	293	30,765	3.2	5.65	0.42	0.40	0.22	98.45	173.82	12.92	12.31	6.77
APU Check Totals						30,765						98.45	173.82	12.92	12.31	6.77
Low Power																
APU Use	On	520	1	40	293	101,573	3.2	5.65	0.42	0.40	0.22	325.03	573.89	42.66	40.63	22.35
Main eng run	1000	520	1	15	1000	130,000	2.65	7.61	0.61	0.40	3.97	344.50	989.30	79.30	52.00	516.10
Low Power Totals						231,573						669.53	1,563.19	121.96	92.63	538.45
Prop Dynamic Balancing																
APU Use	On	80	1	40	293	15,627	3.2	5.65	0.42	0.40	0.22	50.01	88.29	6.56	6.25	3.44
Main eng run	1500	80	1	15	458	9,160	17.40	1.69	90.98	0.40	3.26	159.38	15.48	833.38	3.66	29.86
Prop Dynamic Totals						24,787						209.39	103.77	839.94	9.91	33.30
Out of Phase Turn																
APU Use	On	42	1	40	293	8,204	3.2	5.65	0.42	0.40	0.22	26.25	46.35	3.45	3.28	1.80
Main eng run	250 (Low Idle)	42	4	30	599	50,316	30.11	3.53	22.32	0.40	3.97	1,515.01	177.62	1,123.05	20.13	199.75
Main eng run	450 (Normal Idle)	42	4	10	756	21,168	5.65	6.35	1.42	0.40	3.97	119.60	134.42	30.06	8.47	84.04
Main eng run	1000	42	4	10	1000	28,000	2.65	7.61	0.61	0.40	3.97	74.20	213.08	17.08	11.20	111.16
Low Power- Two Engine Totals						107,688						1,735.07	571.46	1,173.64	43.08	396.76
High Power																
APU Use	On	100	1	40	293	19,533	2	6.25	0.42	0.40	0.22	39.07	122.08	8.20	7.81	4.30
Main eng run	1500	100	2	10	1200	40,000	1.82	8.43	0.41	0.40	3.97	72.80	337.20	16.40	16.00	158.80
Main eng run	2750	100	2	10	1800.0	60,000	0.94	9.83	0.21	0.40	3.97	56.40	589.80	12.60	24.00	238.20
Main eng run	4300	100	2	10	2219.0	73,967	0.65	10.45	0.16	0.40	3.97	48.08	772.95	11.83	29.59	293.65
Idling engines	250 (Low Idle)	100	2	30	599	59,900	30.11	3.53	22.32	0.40	3.97	1,803.59	211.45	1,336.97	23.96	237.80
High Power Totals						253,400						2,019.93	2,033.48	1,386.01	101.36	694.95
Total Annual Maintenance Test Emissions From P-3 Aircraft												4,732	4,446	3,534	259	1,670
Total Annual Maintenance Test Emissions From P-3 Aircraft (Tons)												2.37	2.22	1.77	0.13	0.84

Notes:

¹ Total maintenance tests from Wyle Laboratories, 2004 (see table A.3).

² Main engine fuel flow and emission indexes from AESO memo reports 9911 Rev B (Apr 2000) and 9908 Rev B (Mar 2000). APU fuel flow and emission indexes from AESO memo report 9911 Rev B (Apr 2000).

³ Fuel used = fuel flow x time-in-mode / 60 / x no. of engines in use x maintenance tests per aircraft year.

⁴ Emissions = fuel used / 1000 x emission index.

TABLE B.7 SUMMARY OF EXISTING MOBILE AIR EMISSIONS

	# Aircraft	Operation	# Operations (from Table A.1)	LBS Emissions per operation					(TPY)					
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10	
EA-6B	72	LTOs, w/ Straight In Arrival	2,820											
See table B.5 for emission factors		LTOs, w/Break at Arrival	1,996											
		EA-6B LTO, straight in, w/ hot refuel	1,128	65.04	11.66	31.12	0.90	32.57	36.68	6.57	17.55	0.51	18.37	
		EA-6B LTO, straight in, no hot refuel	1,692	50.51	11.04	23.77	0.79	27.39	42.73	9.34	20.11	0.67	23.17	
		EA-6B LTO, break, w/hot refuel	798	64.87	11.56	31.19	0.87	31.57	25.90	4.61	12.45	0.35	12.60	
		EA-6B LTO, break, no hot refuel	1,198	50.34	10.94	23.83	0.77	26.39	30.15	6.55	14.27	0.46	15.80	
		Total FCLPs	15,316	2.95	4.65	0.50	0.24	5.83	22.60	35.61	3.82	1.84	44.64	
		GCA Box	4,119	6.24	7.43	0.97	0.42	11.18	12.84	15.30	1.99	0.87	23.02	
		T&G	4,797	2.95	4.65	0.50	0.24	5.83	7.08	11.15	1.20	0.58	13.98	
See table B.8 for Maint. Testing emission factors														
See table B.8 for Maint. Testing emission factors	72	Maintenance Testing							49.10	11.32	20.82	0.79	27.68	
LTO emission factors from AESO Memorandum Report No. 9917, Revision B, May 2000 FCLP, T&G and GCA Box emission factors from AESO Memorandum Report No. 9941A, August 2002 FCLP totals include Whidbey and Couplville totals. For FCLP and T&G operations, each cycle (departure and arrival) is counted as one operation. Therefore, totals will be one half totals from table A.1 Assumptions: Hot refuel occurs for 40% of LTOs (LCDR Gamburg, NAS Whidbey, Feb 2004) Depart-Re-enter operations are counted as GCA Box Operations for air emission estimating purposes														
TOTAL EA-6B EMISSIONS									227.07	100.45	92.20	6.07	179.28	
	# Aircraft	Operation	# Operations (from Table A.1)	LBS Emissions per operation					(TPY)					
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10	
P-3		Average LTO	8,183	37.50	21.21	24.59	1.34	10.79	153.44	86.77	100.60	5.47	44.13	
		FCLPs	0	0.69	1.75	0.47	0.47	1.04	0.00	0.00	0.00	0.00	0.00	
See Table for LTO emission factors		GCA Box	4,836	1.13	3.78	0.57	0.56	1.99	2.74	9.13	1.37	1.36	4.82	
		T&G	6,556	0.69	1.75	0.47	0.47	1.04	2.28	5.74	1.54	1.53	3.40	
See Table for maintenance testing emission factors		LBS Emission per aircraft, per year					TPY							
		Maintenance Testing		0.00	0.00	0.00	0.00	0.00	2.37	2.22	1.77	0.13	0.84	
data source: LTO emission factors from AESO Memorandum Report FCLP, T&G and GCA Box emission factors from AESO Memorandum Report Assumptions: Hot refuel occurs for 0% of LTOs This A/C does not do Break arrivals.														
TOTAL P-3 EMISSIONS									160.82	103.86	105.28	8.49	53.18	
	# Aircraft	Operation	# Operations (from Table A.1)	LBS Emissions per operation					(TPY)					
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10	
C-9		Average LTO	325	33.33	18.62	8.78	1.02	33.10	5.41	3.02	1.42	0.17	5.37	
See Table B.6 for LTO emission factors														
TOTAL C-9 EMISSIONS									5.41	3.02	1.42	0.17	5.37	
C-12		Average LTO	100	3.35	0.93	0.82	0.08	0.84	0.17	0.05	0.04	0.00	0.04	
See Table B.6 for LTO emission factors														
TOTAL C-12 EMISSIONS									0.17	0.05	0.04	0.00	0.04	
Transient (P-3)		Average LTO	252	37.50	21.21	24.59	1.34	10.79	4.73	2.67	3.10	0.17	1.36	
See Table B.6 for LTO emission factors														
TOTAL C-12 EMISSIONS									4.73	2.67	3.10	0.17	1.36	
TOTAL EXISTING AIRCRAFT MOBILE EMISSIONS									398.18	210.05	202.04	14.89	239.23	

TABLE B.8 SUMMARY OF PROJECTED MOBILE AIR EMISSIONS

EA -18G Operations: Projected Emissions													
EA-18G	# Aircraft	Operation	# Operations (from Table A.2)	LBS Emissions per operation					(TPY)				
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10
	57	LTOs, w/ Straight In Arrival	2,687										
		LTOs, w/Break at Arrival	1,901										
		LTO w/Straight In, w/ hot refuel, w/AB	860	264.34	23.04	66.14	0.98	18.35	113.65	9.90	28.43	0.42	7.89
		LTO w/Straight In, w/o hot refuel, w/ AB	1290	230.63	21.87	44.67	0.84	13.51	148.73	14.10	28.80	0.54	8.71
		LTO w/Straight In, w/ hot refuel, w/o AB	215	100.55	21.60	63.25	0.80	18.83	10.81	2.32	6.80	0.09	2.02
		LTO w/Straight In, w/o hot refuel, w/o AB	322	66.84	20.43	41.78	0.66	13.99	10.78	3.29	6.74	0.11	2.26
		LTO w/Break, w/ hot refuel, w/AB	608	265.78	23.31	66.66	0.96	17.94	80.84	7.09	20.27	0.29	5.46
		LTO w/Break, w/o hot refuel, w/ AB	912	232.07	22.14	45.19	0.81	13.10	105.88	10.10	20.62	0.37	5.98
		LTO w/Break, w/ hot refuel, w/o AB	152	101.99	21.87	63.77	0.78	18.42	7.76	1.66	4.85	0.06	1.40
		LTO w/Break, w/o hot refuel, w/o AB	228	68.28	20.70	42.30	0.64	13.58	7.79	2.36	4.83	0.07	1.55
		FCLPs	12,201	0.47	9.01	0.07	0.22	3.04	2.85	54.97	0.41	1.36	18.53
		GCA Box	3,924	0.93	18.02	0.13	0.45	6.08	1.83	35.36	0.26	0.88	11.92
		T&G	4,570	0.47	9.01	0.07	0.22	3.04	1.07	20.59	0.15	0.51	6.94
		Maintenance Testing											
									31.57	6.50	7.73	0.29	5.62
									523.54	168.25	129.89	4.99	78.28
data source: LTO emission factors from AESO Memorandum Report No. 9815, Revision E, Nov 2002 (see table B.1) FCLP, T&G and GCA Box emissions factors from AESO Memorandum Report No. 9933B, Dec 2001 FCLP totals include Whidbey and Couplville totals. For FCLP and T&G operations, each cycle (departure and arrival) is counted as one operation. Therefore, totals will be one half totals from table A.2 Assumptions: 41% Percentage of Break arrivals (Wyle, Oct 2004 see table A-2) 40% Percentage of LTO's with Hot Refuel (LCDR Gamburg, NAS Whidbey, Feb 2004) 80% Percentage of A/B usage for Takeoffs (Wyle, Oct 2004, Table 4-2)													
									523.54	168.25	129.89	4.99	78.28
EA -18G Operations: Projected Emissions													
P-3	# Aircraft	Operation	# Operations (from Table A.2)	LBS Emissions per operation					(TPY)				
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10
	42	Average LTO	8,183	37.50	21.21	24.59	1.34	10.79	153.44	86.77	100.60	5.47	44.13
		FCLPs	0	0.69	1.75	0.47	0.47	1.04	0.00	0.00	0.00	0.00	0.00
		GCA Box	4,836	1.13	3.78	0.57	0.56	1.99	2.74	9.13	1.37	1.36	4.82
		T&G	6,556	0.69	1.75	0.47	0.47	1.04	2.28	5.74	1.54	1.53	3.40
		Maintenance Testing							2.37	2.22	1.77	0.13	0.84
									160.82	103.86	105.28	8.49	53.18
data source: LTO emission factors from AESO Memorandum Report FCLP, T&G and GCA Box emission factors from AESO Memorandum Report Assumptions: Hot refuel occurs for 40% LTOs													
									160.82	103.86	105.28	8.49	53.18
EA -18G Operations: Projected Emissions													
C-9	# Aircraft	Operation	# Operations (from Table A.2)	LBS Emissions per operation					(TPY)				
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10
	4	Average LTO	325	33.33	18.62	8.78	1.02	33.10	5.41	3.02	1.42	0.17	5.37
		Maintenance Testing											
									5.41	3.02	1.42	0.17	5.37
data source: LTO emission factors from AESO Memorandum Report													
									5.41	3.02	1.42	0.17	5.37
EA -18G Operations: Projected Emissions													
C-12	# Aircraft	Operation	# Operations (from Table A.2)	LBS Emissions per operation					(TPY)				
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10
	2	Average LTO	0	3.35	0.93	0.82	0.08	0.84	0.00	0.00	0.00	0.00	0.00
		Maintenance Testing											
									0.00	0.00	0.00	0.00	0.00
data source: LTO emission factors from AESO Memorandum Report													
									0.00	0.00	0.00	0.00	0.00
EA -18G Operations: Projected Emissions													
Transient (P-3)	# Aircraft	Operation	# Operations (from Table A.2)	LBS Emissions per operation					(TPY)				
				CO	NOx	VOC	SO2	PM10	CO	NOx	VOCs	SO2	PM10
		Average LTO	252	37.50	21.21	24.59	1.34	10.79	4.73	2.67	3.10	0.17	1.36
		Maintenance Testing											
									4.73	2.67	3.10	0.17	1.36
data source: LTO emission factors from AESO Memorandum Report													
									4.73	2.67	3.10	0.17	1.36
									694.49	277.81	239.69	13.81	138.19
									296.30	67.76	37.65	-1.08	-101.04

Table B.9 EMISSION FACTORS FOR PRIVATELY OWNED VEHICLES, NAS WHIDBEY ISLAND

Fleet Year	Type of Vehicle	EPA Category	Emission Factor (g/mile)				
			NOx	CO	PM	SO2	VOC
2004	Cars	LDGV	1.051	18.998	0.0263	0.0275	1.277
	Pickups under 6000 lbs	LDGT1,2	1.409	23.777	0.0275	0.0351	1.524
	Trucks under 8500 lbs, over 6000 lbs	LDGT3,4	2.02	31.75	0.0291	0.0459	2.505

Source: Mobile 6.2, Using default parameters for Whidbey Island, WA

Table B.10 Residential Distribution of NAS Whidbey Island Personnel

CITY	ZIP	Distance from base (miles)	% of base population	Distance x Percentage
ANACORTES	98221	15.66	4.80%	0.75
BURLINGTON	98233	27.87	1.60%	0.45
CLINTON	98236	40.37	0.40%	0.16
COUPEVILLE	98239	15.25	3.70%	0.56
FREELAND	98249	30.52	0.30%	0.09
GREENBANK	98253	24.98	0.30%	0.07
LA CONNER	98257	19.25	0.20%	0.04
LANGLEY	98260	37.11	0.20%	0.07
MOUNT VERNON	98273	23.7	0.00%	0.00
MOUNT VERNON	98274	32.41	3.20%	1.04
OAK HARBOR	98277	3.73	81.60%	3.04
OAK HARBOR	98278	0	0.00%	0.00
CAMANO IS	98282	48.3	2.30%	1.11
SEDRO-WOLLEY	98284	32.21	1.40%	0.45
CAMANO IS/STANWOOD	98292	45.4	0.00%	0.00
	Average	26.45	Weighted Ave	7.85

Table B.11 PROJECTED CRITERIA AIR POLLUTANT EMISSIONS FROM PRIVATELY OWNED VEHICLES, NAS WHIDBEY ISLAND

Group	Vehicle Type	EPA Category	Daily Vehicles (/day)	Daily Travel - Per Vehicle			Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (lb/yr)				
				On-Base (VMT)	Off-Base (VMT)	Total (VMT)			NOx	VOC	CO	SO2	PM
Existing POV Commute Emissions	Cars (60%)	LDGV	6,627	3	7.85	10.84519	247	17752155.3	41132.1	49976.9	743508.5	1076.2	1029.3
	Pickups under 6000 lbs (30%)	LDGT1,2	3314	3	7.85	10.84519	247	8876077.7	20566.0	24988.4	371754.2	538.1	514.6
	Trucks under 8500 lbs, over 6000 lbs	LDGT3,4	1104.5	3	7.85	10.84519	247	2958692.6	6855.3	8329.5	123918.1	179.4	171.5
	Total	-	11,045	-	-	-	-	-	68553.5	83294.8	1239180.8	1793.7	1715.5
total tons emissions									34.3	41.6	619.6	0.9	0.9
Projected POV Commute Emissions	Cars	LDGV	5,963	3	7.85	10.84519	247	15974528.9	37013.3	44972.4	669056.7	968.5	926.2
	Pickups/Light Trucks	LDGT	2982	3	7.85	10.84519	247	7987264.4	18506.6	22486.2	334528.3	484.2	463.1
	Pickups/Light Trucks	LDDT	993.9	3	7.85	10.84519	247	2662421.5	6168.9	7495.4	111509.4	161.4	154.4
	Total	-	9,939	-	-	-	-	-	61688.8	74954.0	1115094.4	1614.1	1543.7
total tons emissions									30.8	37.5	557.5	0.8	0.8
Change in emissions									-3.4	-4.2	-62.0	-0.1	-0.1

Refer to section 3.3.1 for description and explanation of population data.

Table B.12 Annual Emissions from Ground Support Equipment Operations, 2003-2013

	Operation (hours/yr) 2003 Baseline	Emission Rate					Total Emissions: (TPY)					
		VOC lb/hr	NOX lb/hr	CO lb/hr	SO2 lb/hr	PM-10 lb/hr	VOC TPY	NOX TPY	CO TPY	SO2 TPY	PM-10 TPY	
2003 Landing/TakeOff Flight Operations:	13675											
<i>Tow Tractors: (a)</i>												
A/S32A-30A (Small tow)	31092	0.03	0.26	0.10		0.04	0.39	4.04	1.55	0.00	0.68	
<i>Flight Line Electric Power Units (a)</i>												
NC8A	2240	0.75	3.83	0.46		0.39	0.84	4.29	0.52	0.00	0.44	
NC10C	6606	0.38	3.22	0.34		0.16	1.26	10.64	1.12	0.00	0.53	
<i>Jet Engine Start Units (a)</i>												
A/M47A-4/NCPP-105 (b)	7005	5.13	1.14	10.80		1.51	17.97	3.99	37.83	0.00	5.29	
GTC-85	1704	0.09	0.70	3.20		0.22	0.08	0.60	2.73	0.00	0.19	
<i>Miscellaneous: (a), (c)</i>												
A/S48M-2 Manlift	4208	0.53	0.64	0.86		0.03	1.12	1.35	1.81	0.00	0.06	
A/M32C-17 (mobile ac)	6268	0.29	5.02	0.33		0.09	0.91	15.73	1.03	0.00	0.29	
A/M27T-5 (hydraulic unit)	6774	0.31	1.95	0.25		0.06	1.05	6.60	0.85	0.00	0.19	
A/M42M-2 (floodlight cart)	3955	0.11	0.23	0.19		0.01	0.22	0.45	0.38	0.00	0.01	
HLU-196 (bomb lift)	2690	0.11	0.23	0.19		0.01	0.15	0.31	0.26	0.00	0.01	
Misc Carts (water, lav, B%B)	2308	0.38	3.22	0.34		0.16	0.44	3.72	0.39	0.00	0.18	
(using small power plant EFs)												
Total	74850.00						24.41	51.72	48.46	0.00	7.87	
2013 Landing/Take Off Flight Operations:	13348											
<i>Tow Tractors: (a)</i>												
A/S32A-30A (Small tow)	30347	0.03	0.26	0.10		0.04	0.38	3.95	1.52	0.00	0.67	
<i>Flight Line Electric Power Units (a)</i>												
NC8A	2186	0.75	3.83	0.46		0.39	0.82	4.19	0.50	0.00	0.43	
NC10C	6448	0.38	3.22	0.34		0.16	1.23	10.38	1.10	0.00	0.52	
<i>Jet Engine Start Units (a)</i>												
A/M47A-4/NCPP-105 (b)	6837	5.13	1.14	10.80		1.51	17.54	3.90	36.92	0.00	5.16	
GTC-85	1663	0.09	0.70	3.20		0.22	0.07	0.58	2.66	0.00	0.18	
<i>Miscellaneous: (a), (c)</i>												
A/M32C-17 (mobile ac)	6118	0.29	5.02	0.33		0.09	0.89	15.36	1.01	0.00	0.28	
A/M27T-5 (hydraulic unit)	6612	0.31	1.95	0.25		0.06	1.02	6.45	0.83	0.00	0.18	
A/M42M-2 (floodlight cart)	3860	0.11	0.23	0.19		0.01	0.21	0.44	0.37	0.00	0.01	
HLU-196 (bomb lift)	2626	0.11	0.23	0.19		0.01	0.14	0.30	0.25	0.00	0.01	
Misc Carts (water, lav, B%B)	2253	0.11	0.23	0.19		0.01	0.12	0.26	0.21	0.00	0.01	
(using small power plant EFs)												
Total							22.43	45.80	45.36	0.00	7.46	
							Change in emissions	-1.98	-5.92	-3.10	0.00	-0.41

Notes:

(a) Emission Factors from Final Report for Emission Testing on Ground Support Equipment at Naval Air Stations, February 2000, Navy, Atlantic Division.

(b) Emission factor for GTC100 used.

(c) A/M32C-17 assumed equivalent to "mobile AC"; A/M27T-5 assumed equivalent to "hydraulic test unit"; A/M42M-2 assumed equivalent to "floodlight"; HLU-196 assumed equivalent to size of floodlight cart.

SO2 emission factors are not available

TABLE B.13: PROJECTED EMISSIONS RATES FROM AIRCRAFT ENGINE TEST CELL OPERATIONS (EA-18G), (SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft) F414-GE-400	Power Setting(1),(2)	Time in Power Setting (2) (minutes)	Fuel Flow (lb/hr/eng)	Fuel Flow (lb/min/eng)	Fuel Usage (3) (lbs/test/eng)	Emission Index (3) lb /1000 lb fuel					Engine Test Emissions (pounds)				
						VOC (4)	NOx	CO	SO2	PM10	VOC (5)	NOx	CO	SO2	PM10
Warm Up	Flt idle	25	862.00	14.37	359.17	36.63	3.55	72.17	0.4	12.17	13.16	1.28	25.92	0.14	4.37
Step 1	81.3	5	3603.00	60.05	300.25	0.12	10.53	1.09	0.4	6.19	0.04	3.16	0.33	0.12	1.86
Step 2	88.4	5	6809.00	113.48	567.42	0.12	20.62	0.69	0.4	3.48	0.07	11.70	0.39	0.23	1.97
Step 3	91.3	5	8468.00	141.13	705.67	0.12	24.52	0.69	0.4	2.85	0.08	17.30	0.49	0.28	2.01
Step 4	93.2	5	9351.00	155.85	779.25	0.12	29.23	0.69	0.4	2.25	0.09	22.78	0.54	0.31	1.75
Step 5	96.5	10.00	11893.00	198.22	1982.17	0.12	34.94	0.69	0.4	1.66	0.24	69.26	1.37	0.79	3.29
Step 6	1.0	7.00	11893.00	198.22	1387.52	0.12	34.94	0.69	0.4	1.66	0.17	48.48	0.96	0.56	2.30
IRP	IRP	10.00	11893.00	198.22	1982.17	0.12	34.94	0.69	0.4	1.66	0.24	69.26	1.37	0.79	3.29
A/B	Max A/B	3.00	39678.00	661.30	1983.90	4.72	9.47	262.12	0.4	No Data	9.36	18.79	520.02	0.79	0.00
Stud Down	Flt idle	10.00	862.00	14.37	143.67	36.63	3.55	72.17	0.4	12.17	5.26	0.51	10.37	0.06	1.75
	Total	85.00			10191.17						28.71	205.78	523.71	2.93	8.88
											0.01	0.10	0.26	0.00	0.00
											0.00	0.00	0.00	0.00	0.00
											4.84	14.65	12.24	0.64	14.06

Total EA-18 G tests: 71

Notes:

1. Performance Test Time in Mode, Fuel Flow, and Emissions Indexes Draft AESO Memorandum Report 2000-21 July 2000.
2. Total number of tests from Wyle Laboratories, 2004 (see table A.3)

Key:

A/B =	maximum afterburner
VOC =	volatile organic compounds
NOx =	oxides of nitrogen
CO =	carbon monoxide
SO2 =	sulfur dioxide
PM10 =	particulate matter

TABLE B.14: EXISTING EMISSIONS FOR AIRCRAFT ENGINE TEST CELL OPERATIONS (EA-6B), (SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft)	Power Setting	Time in Power Setting ¹ (minutes)	Fuel Flow (lb/hr/eng)	Fuel Flow (lb/min/eng)	Fuel Usage ² (lbs/test/eng)	% Fuel use in Power Setting ¹	Emission Index ³ lb /1000 lb fuel					Single Engine Test Emissions (lbs emissions per 1000 lbs, based on % fuel use per mode) ¹				
							VOC ⁴	NOx	CO	SO2	PM10	VOC ⁴	NOx	CO	SO2	PM10
							J52-P-408A (EA-6B)	Gr Idle (56%)	25.00	779.00	12.98	324.58	0.08	28.33	2.38	55.96
	76%	10.00	2554.00	42.57	425.67	0.11	1.42	5.05	11.16	0.4	13.44	0.16	0.56	1.23	0.04	1.49
	90%	10.00	5594.00	93.23	932.33	0.24	0.7	8.18	3.33	0.4	8.83	0.17	1.98	0.81	0.10	2.14
	97%	10.00	8278.00	137.97	1379.67	0.36	0.57	10.95	1.74	0.4	6.53	0.20	3.92	0.62	0.14	2.34
	100%	5.00	9479.00	157.98	789.92	0.21	0.57	12.32	1.47	0.4	5.73	0.12	2.53	0.30	0.08	1.17
	Total	60.00			3852.17						Pounds Emissions Per 1000 lbs fuel:	3.03	9.19	7.68	0.40	8.82

	Reported Emissions (TPY)				
	VOC ⁴	NOx	CO	SO2	PM10
2002 Annual Reported Emissions	5.32	16.12	13.47	0.70	15.47
2003 Annual Reported Emissions	4.35	13.18	11.02	0.57	12.65
Average 2002/2003 emissions	4.84	14.65	12.24	0.64	14.06

Fuel burned at test cell (lbs) ⁵	
2002	516000.00
2003	422000.00
lbs fuel per gallon	6.80

Notes:

¹Power setting, time in power setting, and calculation of emissions per mode using % of fuel use is described in Whidbey Island Air Operating Permit Number 008, issued July 27, 2004.

²Assumes a product density of 6.8 lb/gallon for JP-5.

³Fuel Flow and Emissions Indexes from AESO memo. 9725A and 2002-05..

⁴Aircraft VOC reported as HC in the form CH_y/x

⁵As reported to NWAPA, 2004 Title V emission inventory submission (information from Keith Kuenzi, NAS Whidbey 2004)

Key:

- VOC = volatile organic compounds
- NOx = oxides of nitrogen
- CO = carbon monoxide
- SO2 = sulfur dioxide
- PM10 = particulate matter
- A/B = maximum afterburner
- 75% = 75% throttle setting

B2

Construction Emissions

Vehicle Engine Exhaust from Grading and Material Hauling Activities

Emission Factors for Vehicle Engine Exhaust from Construction Activities

Total Daily Vehicle Engine Exhaust Emissions from Construction Activities

Total Vehicle Engine Exhaust Emissions from Construction Activities

Fugitive Emissions from Construction Activities

Equation Used to Calculate Operation Parameters

Equations Used to Calculate Mass/Unit Emission Factors (Corrected for PM₁₀)

Emission Factors for Fugitive Emissions from Construction Activities

Calculation of Annual Fugitive Emissions from Construction Activities

Demolition Particulate Emissions

CALCULATION OF CONSTRUCTION EMISSIONS
NAS Whidbey Island

Construction Emissions: Vehicle Engine Exhaust from Grading and Material Hauling Activities

Input Parameters/Assumptions:	
Total Building Area:	20,000 ft ²
Total Paved Area:	10,000 ft ²
Total Disturbed Area:	3.00 acres
Construction Duration:	0.25 years
Annual Construction Activity:	250 days/yr
Total Demolition:	10,000 ft ²

Emission Factors for Vehicle Engine Exhaust from Construction Activities

Activity	SMAQMD Emission Factor									
	ROG ¹		NO _x		SO ₂ ²		CO ²		PM ₁₀	
Grading Equipment ³	2.91E-01	lbs/acre/day	2.75E+00	lbs/acre/day	0.18	lbs/acre/day	0.60	lbs/acre/day	2.32E-01	lbs/acre/day
Material Hauling ⁴	4.20E-01	lbs/acre/day	6.07E+00	lbs/acre/day	0.40	lbs/acre/day	1.31	lbs/acre/day	4.30E-01	lbs/acre/day

Reference: *Air Quality Thresholds of Significance*, Sacramento Metropolitan Air Quality Management District (SMAQMD), 1994 and *Compilation of Air Pollutant Emission Factors* (USEPA AP-42).

¹ ROG = VOC.

² Factors for grading equipment are calculated from AP-42 for diesel engines using ratios with the NO_x factors.

³ Grading Activities assumes the use of one tracked loader, one wheeled loader, and one motor grader for each 10 acres of disturbed area, used 8 hours per day.

⁴ Material Hauling Activities assumes the use of one loader and one haul truck for each 10 acres of disturbed area, used 8 hours per day.

Total Daily Vehicle Engine Exhaust Emissions from Construction Activities¹

Activity	ROG	NO _x	SO ₂	CO	PM ₁₀
Grading Equipment	0.9	8.3	0.5	1.8	0.7
Material Hauling	1.3	18.2	1.2	3.9	1.3
Total Emissions (lbs/day):	2.1	26.5	1.8	5.7	2.0

¹ Total Emissions (lbs/day) = Emission Factor * Affected Acres

Total Vehicle Engine Exhaust Emissions from Construction Activities¹

Activity	ROG	NO _x	SO ₂	CO	PM ₁₀
Grading Equipment	0.03	0.26	0.02	0.06	0.02
Material Hauling	0.04	0.57	0.04	0.12	0.04
Demolition					0.6
Fugitive Emissions (from page 2)					5.57
Total Emissions(tons/yr)	0.07	0.83	0.06	0.18	5.63

¹ Total emissions (TPY) = Total emissions (lbs/day) * days of construction / 2000 lbs per ton

Construction Emissions: Fugitive Emissions from Construction Activities

Input Parameters / Assumptions

Acres affected:	3.0	acres/yr
Grading days/yr:	30	days/yr
Exposed days/yr:	90	days/yr graded area is exposed
Grading Hours/day:	8	hr/day
Soil percent silt, s:	15	%
Soil percent moisture, M:	2	%
Fraction of TSP, J:	0.5	(SCAQMD recommendation)
Mean vehicle speed, S:	5	mi/hr (On-site)
Dozer path width:	5	ft
Qty construction vehicles:	3	vehicles
On-site VMT/vehicle/day:	5	mi/veh/day (Excluding bulldozer VMT during grading)

Reference: CEQA Air Quality Handbook, SCAQMD, April 1993.

Equation Used to Calculate Operation Parameters

Operation Parameter	Emission Factor	Equation
Grading duration per acre	80 hr/acre	Grading days * hours per day / acres affected
Bulldozer mileage per acre	1.7 VMT/acre	Miles traveled by bulldozer, based on dozer path width
Construction VMT per day	15 VMT/day	Number of vehicle * VMT per vehicle per day
Construction VMT per acre	150 VMT/acre	Construction VMT * days of construction / acres affected (Travel on unpaved surfaces within site)

Equations Used to Calculate Mass/Unit Emission Factors (Corrected for PM₁₀)

Operation	Empirical Equation	Units	AP-42 Section (4th Edition)
Bulldozing	$0.75(s^{1.5})/(M^{1.4})$	lbs/hr	8.24, Overburden
Grading	$(0.60)(0.051)S^{2.0}$	lbs/VMT	8.24, Overburden
Vehicle Traffic	$(3.72/(M^{4.3})) * 0.6$	lbs/VMT	8.24, Overburden

Reference: *Compilation of Air Pollutant Emission Factors*, USEPA AP-42;
Section 8.24, Western Surface Coal Mining (4th Edition)

Emission Factors for Fugitive Emissions from Construction Activities¹

Operation	Emission Factor (mass/ unit)	Operation Parameter	Emission Factor (lbs/acre)
Bulldozing	16.51 lbs/hr	80 hr/acre	1320.8 lbs/acre
Grading	0.77 lbs/VMT	1.7 VMT/acre	1.3 lbs/acre
Vehicle Traffic	0.11 lbs/VMT	150 VMT/acre	16.5 lbs/acre

¹ Emission Factor (lbs/acre) = Emission Factor (lbs per hour or VMT) * Operation Parameter (hours of VMT per acre)

Calculation of Annual Fugitive Emissions from Construction Activities

Source	Emission Factor	Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing ¹	1320.8 lbs/acre	3.00	NA	3,962	1.98
Grading ¹	1.3 lbs/acre	3.00	NA	4	0.00
Vehicle Traffic ¹	16.5 lbs/acre	3.00	NA	50	0.02
Erosion of Graded Surface ²	26.4 lbs/acre/day ³	3.00	90	7,128	3.56
TOTAL				11,144	5.57

¹ Total annual emissions (TPY) = Emission Factor (lbs/acre) * affected acres * 2000 lbs per ton

² Total annual emissions (TPY) from erosion = Emission Factor (lbs/acre) * days of construction * 2000 lbs per ton

³ Reference: CEQA Air Quality Handbook, SCAQMD, April 1993.

Demolition Particulate Emissions

Calculation of PM Emissions		
Space to be demolished	(SQ FT)	10,000.00
Emission from Structure removal	(LBS)	5.1
Emissions from debris removal	(LBS)	94.0
Emissions from vehicle activity	(LBS)	1064.5
Total PM ₁₀ emissions	LBS/YR	1163.60
Total PM₁₀ emissions	TPY	0.58

Notes:

- (2) PM emission from structure takedown based on sq ft *EF
- (3) PM emission from debris removal based on sq ft *EF
- (4) PM emission from on-site vehicle activity based on sq ft *EF
- (5) Pushing (bulldozing) PM emission put under site prep spreadsheet
- (6) Reference EPA-450/2-92-004 (Fugitive Dust document)
(all EF's in EPA document converted to english units)