Appendix A: Air Quality Calculations

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CONSTRUCTION EMISSIONS

Clearing			1 Acres							
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Dozer	12	145	0.58	0.38	1.41	4.17	0.12	0.30	0.29	536
Loader/Backhoe	12	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692
Small Backhoe	12	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	692
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
			Dozer	0.81	3.04	8.98	0.25	0.64	0.62	1,152.14
			Loader w/ integral Backhoe	0.67	3.43	2.97	0.07	0.50	0.48	323.17
			Small backhoe	0.42	2.17	1.88	0.04	0.31	0.30	204.30
On-road Equipment	**Hours of Operation**	**Engine HP**	**Speed (mph)**	**VOC** lb/mile	**CO** lb/mile	**NOx** lb/mile	**SO_2** lb/mile	**PM10** lb/mile	**PM2.5** lb/mile	**CO_2** lb/mile
Dump Truck	5	230	45	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**CO_2** lb
			Dump Truck	0.36	1.92	8.62	0.00	0.36	0.35	822
			Subtotal in lbs	2	11	22	0	2	2	2501
			Clearing Grand Total in Tons	**0.00**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**	**1.3**
			Clearing Grand Total in Metric Tons							**1.1**

Site Prep - Excavate/Fill - Trenching - Grading										
Site Prep - Excavate/Fill (CY)	24,293	CY								
Trenching (LF)	2,233	LF		248	CY					
Grading (SY)	39,037	SY			Assume compact 0.5 feet (0.166 yards)			6,480	CY compacted	
Off-road Equipment	**Hours**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Excavator	81	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	536
Skid Steer Loader	97	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	536
Dozer (Rubber Tired)	88	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	536
Compactor	30	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	536
Grader	14	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	536
Backhoe/Loader	4	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**CO_2** lb
			Excavator	8.80	30.95	103.14	2.95	5.70	5.53	13,713.51
			Skid Steer Loader	3.02	11.59	34.20	0.91	2.41	2.34	4,223.02
			Dozer (Rubber Tired)	6.25	23.48	69.28	1.91	4.91	4.77	8,892.87
			Compactor	1.56	6.20	18.04	0.46	1.26	1.22	2,116.41
			Grader	1.74	6.10	20.56	0.58	1.14	1.11	2,706.74
			Backhoe/loader	0.14	0.50	1.70	0.05	0.10	0.09	214.90
On-road Equipment	**# trips**	**Engine HP**	**ave RT distance (mi)**	**VOC** lb/mile	**CO** lb/mile	**NOx** lb/mile	**SO2** lb/mile	**PM** lb/mile	**PM2.5** lb/mile	**CO_2** lb/mile
Dump Truck	2,024	265	60	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**CO_2** lb
			Delivery Truck	184.79	976.81	4381.20	2.19	182.74	177.06	417657.28
			Subtotal (lbs):	**188**	**206**	**1056**	**4628**	**9**	**198**	**192**
			Site Prep Work Grand Total in Tons	**0.09**	**0.10**	**0.53**	**2.31**	**0.00**	**0.10**	
			Site Prep Work Grand Total in Metric Tons							**0.09**

Gravel Work	9,349	CY								
Off-road Equipment	**Hours**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM_{10}** g/hp-hr	**$PM_{2.5}$** g/hp-hr	**CO_2** g/hp-hr
Dozer	88	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	536
Wheel Loader for Sprea	110	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	536
Compactor	244	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	536
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**CO_2** lb
			Dozer	7.31	25.67	86.76	2.45	4.81	4.66	11,394
			Wheel Loader for Spreading	4.36	15.60	52.92	1.44	2.98	2.89	6,697
			Compactor	8.56	31.86	105.94	2.74	6.12	5.93	12,749
On-road Equipment	**# trips**	**Engine HP**	**ave RT distance (mi)**	**VOC** lb/mile	**CO** lb/mile	**NOx** lb/mile	**SO2** lb/mile	**PM** lb/mile	**PM2.5** lb/mile	**CO_2** lb/mile
Dump Truck	675	265	60	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**CO_2** lb
			Delivery Truck	61.60	325.60	1460.40	0.73	60.91	59.02	139219.09
			Subtotal (lbs):	**82**	**83**	**401**	**1715**	**8**	**75**	**73**
	Gravel Work Grand Total in Tons			**0.04**	**0.04**	**0.20**	**0.86**	**0.00**	**0.04**	
	Gravel Work Grand Total in Metric Tons									**0.03**

Concrete Work - Foundation and Sidewalks										
	Total	14,098	CY	Note: Assume all excavated soil is accounted for in Excavate/Fill and Trenching						
				Emission Factors						
Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO_2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**CO_2** g/hp-hr
Concrete Mixer	298	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	588
Concrete Truck	269	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	530
				Annual Emissions						
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**CO_2** lb
			Concrete Mixer	0.68	3.01	6.10	0.13	0.53	0.52	581.57
			Concrete Truck	29.08	133.77	473.73	8.73	20.59	19.97	40,603.01
			Subtotal (lbs):	**30**	**137**	**480**	**9**	**21**	**20**	**41,185**
	Concrete Work Grand Total in Tons			**0.01**	**0.07**	**0.24**	**0.00**	**0.01**	**0.01**	21
	Concrete Work Grand Total in Metric Tons									**19**

Flight Simulator Facility

52,052 SF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Crane	260	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	530
Diesel Generator	260	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	536
Telehandler	208	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Scissors Lift	521	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595
Skid Steer Loader	416	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	691
Pile Driver	260	260	0.43	0.46	1.55	5.90	0.11	0.31	0.30	530
All Terrain Forklift	10	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	595

	VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
	Annual Emissions						
Crane	26.98	133.93	577.64	12.53	22.81	22.13	58,238
Diesel Generator	2.59	13.90	34.62	1.07	2.29	2.22	5,292
Telehandler	13.66	105.63	132.15	3.43	13.97	13.55	15,942
Scissors Lift	28.63	221.40	276.99	7.19	29.28	28.41	33,415
Skid Steer Loader	61.42	289.15	243.07	5.39	43.15	41.86	25,072
Pile Driver	29.77	99.55	378.60	7.31	20.13	19.53	33,975
All Terrain Forklift	0.56	4.30	5.39	0.14	0.57	0.55	650
Subtotal (lbs):	**262**	**1389**	**3986**	**38**	**230**	**223**	**395,401**
Building Construction Grand Total in Tons	**0.13**	**0.69**	**1.99**	**0.02**	**0.11**	**0.11**	
Building Construction Grand Total in Metric Tons							**179**

Hangar Construction

165,628 SF

Off-road Equipment	Cumulative Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Crane	994	330	0.58	0.2457015	1.219507	5.259786	0.11407306	0.207722	0.20149	530.2987216
Diesel Generator	5,320	40	0.43	0.4286042	1.939074	4.940145	0.12671328	0.46087	0.447044	589.0709388
Telehandler	1,656	99	0.59	0.5095397	3.939734	4.928977	0.127904404	0.52112	0.505486	594.613562
Scissors Lift	1,325	83	0.59	0.5095397	3.939734	4.928977	0.127904404	0.52112	0.505486	594.613562
Skid steer loader	828	67	0.59	1.6923812	7.967689	6.697903	0.148593624	1.189147	1.153472	690.8722008
pile driver	818	260	0.43	0.4640382	1.551822	5.901968	0.113927487	0.313865	0.304449	529.6372363
all terrain forklift	818	84	0.59	0.5095397	3.939734	4.928977	0.127904404	0.52112	0.505486	594.613562

On-road Equipment	# trips	Engine HP	distance (mi)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Concrete truck	1,194	300	60	1.66E-03	8.58E-03	3.92E-02	0	1.69E-03	1.64E-03	3

	VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
Crane	103.03	511.38	2205.62	47.84	87.11	84.49	222,374
Diesel Generator	86.47	391.20	996.65	25.56	92.98	90.19	118,842
Telehandler	108.68	840.28	1051.27	27.28	111.15	107.81	126821.33
Scissors Lift	72.89	563.58	705.09	18.30	74.55	72.31	85059.96
Skid steer loader	122.14	575.04	483.40	10.72	85.82	83.25	49861.44
pile driver	93.55	312.84	1189.83	22.97	63.27	61.38	106774.01
all terrain forklift	45.54	352.08	440.49	11.43	46.57	45.17	53138.75
	VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
Concrete truck	78.66	406.64	1858.97	0.86	80.15	77.83	160,321
Subtotal (lbs):	**710.95**	**3953.06**	**8931.32**	**164.96**	**641.60**	**622.44**	**923,192**
Building Construction Grand Total in Tons	**0.36**	**1.98**	**4.47**	**0.08**	**0.32**	**0.31**	
Building Construction Grand Total in Metric Tons							**419**

Material Deliveries

On-road Equipment	# trips	Engine HP	ave RT distance (mi)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Delivery Truck	1,080	265	60	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385
				VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
			Delivery Truck	98.58	521.12	2337.34	1.17	97.49	94.46	222,817
	Building Construction Grand Total in Tons			**0.05**	**0.26**	**1.17**	**0.00**	**0.05**	**0.05**	
	Building Construction Grand Total in Metric Tons									**101**

Building Demolition

153,024 SF 7,651 Estimated CY of debris based on 20 SF/CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO_2 g/hp-hr	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	CO_2 g/hp-hr
				Emission Factors						
Hydraulic excavator	1,275	86	0.59	0.23	2.57	2.68	0.11	0.40	0.39	595.46
Loader /Backhoe	1,275	87	0.23	1.07	6.13	5.02	0.14	0.95	0.92	692.77
air compressor	1,275	49	0.59	0.26	1.41	3.51	0.11	0.23	0.22	536.20
				Annual Emissions						
				VOC lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	CO_2 lb
			Hydraulic excavator	32.66	366.59	382.30	16.21	57.47	55.75	84,928.29
			Loader /Backhoe	60.01	344.66	282.43	7.96	53.37	51.77	38,965.57
			air compressor	21.33	114.49	285.09	8.77	18.84	18.28	43,573.07
			Subtotal (lbs):	114.00	825.74	949.83	32.94	129.68	125.79	167466.93

On-road Equipment	# trips	Engine HP	ave RT distance (mi)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Dump Truck	638	265	60	0.0015	0.0080	0.0361	0.0000	0.0015	0.0015	3.4385
				VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
			Delivery Truck	58.20	307.65	1379.90	0.69	57.56	55.77	131544.82
			Subtotal (lbs):	172.20	1,133.40	2,329.72	33.63	187.24	181.56	299,011.76
	Building Demo Grand Total in Tons			**0.086**	**0.567**	**1.165**	**0.017**	**0.094**	**0.091**	
	Building Demo Grand Total in Metric Tons									**135.63**

Paving Surface and Paving HMA

Pavement - Surface Area	59,681	SF	2,503 CY
Paving - HMA	67,575	CF	

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM g/hp-hr	PM2.5 g/hp-hr	CO_2 g/hp-hr
Grader	183	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	536
Roller	274	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	536
Paving Machine	366	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	536
Asphalt Curbing Machine	37	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	536

	VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
Grader	12.97	48.68	143.45	3.97	10.19	9.89	18,466
Roller	48.81	352.18	791.49	16.48	48.43	46.98	76,619
Paving Machine	29.63	112.48	331.57	8.99	23.39	22.69	41,771
Asphalt Curbing Machine	2.44	9.71	28.22	0.71	1.97	1.91	3,311

On-road Equipment	# trips	Engine HP	distance (mi)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM lb/mile	PM2.5 lb/mile	CO_2 lb/mile
Dump Truck	1,117	230	60	0.001521	0.008042	0.036070	1.80E-05	0.001504	0.001458	3.438541

	VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	CO_2 lb
Dump Truck	101.99	539.15	2,418.19	1.21	100.86	97.73	230,525

Hot Mix Asphalt (HMA	Volume of HMA (ft^3)	Weight of HMA (tons)	VOC lb/ton	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
Standard Hot Mix Asphalt	67,575	4,899	0.04	195.96	-	-	-	-	-	-
			Subtotal (lbs):	**392**	**1,062**	**3,713**	**31**	**185**	**179**	**370,693**
			Paving Grand Total in Tons	**0.20**	**0.53**	**1.86**	**0.02**	**0.09**	**0.09**	
			Paving Grand Total in Metric Tons							**168**

Fugitive Dust Emissions:

PM_{10} tons/acre/mo	acres	days of disturbance	PM_{10} Total	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ Total
0.42	2	90	3	0.1	0.3

Construction Worker POV emissions

	# vehicles	# days	mi/day	VOC lb/mi	CO lb/mi	NOx lb/mi	SO2 lb/mi	PM10 lb/mi	PM2.5 lb/mi	CO_2 lb/mi
annually	30	350	60	0.000547	0.00472	0.00044	1.07216E-05	0.000095	6.3E-05	1.10

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
	344	2972	275	7	60	39	696,125
POV Grand Total in Tons	**0.17**	**1.49**	**0.14**	**0.00**	**0.03**	**0.02**	
POV Total in Metric Tons							**316**

Annual Emission Totals:

VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM_{10} T/yr	$PM_{2.5}$ T/yr	CO_2 MT/yr
1.1	5.7	11.8	3.3	3.6	1.1	1,339

Construction Emission Assumptions for NAS Whiting Field							
	453.59	grams per pound					
2019-2025							
Temp Maintenance Hangar		52,534	sf concrete pad		11	months construction	
Jan - Nov 2020		5,000	sf parking apron				
		3,196	cy excavation		266	trucks of dirt hauled out	
		2,131	cy concrete		237	concrete trucks	
		1,065	cy gravel		89	trucks of gravel hauled in	
		6,393	SY grading		220	Material Deliveries	
		1,100	LF sidewalk				
		1,833	ft trenching				
Temp GBTS Structure		16,440	sf concrete pads		2	months construction	
Oct 2019 - May 2021		32,880	cf excavation		40	Material Deliveries	
		1,218	cy excavation		101	trucks of dirt hauled out	
		812	cy concrete		90	concrete trucks	
		406	cy gravel		34	trucks of gravel hauled in	
		1,827	SY grading				
Maintenance Hangar		165,628	sf bldg		30	months construction duration	
Oct 2022 - May 2025		331,256	cf excavation		600	Material Deliveries	
		12,269	cy excavation		1,022	trucks of dirt hauled out	
		8,179	cy concrete		909	concrete trucks	
		4,090	cy gravel		341	trucks of gravel hauled in	
		300	ft trenching				
		1	acre land clearing				
		841	piles		53	truckloads at 16 2-ft wide/load	
		18,403	SY grading				
Apron, Towway		23,681	sf asphalt		6	months construction duration	
Oct 2022 - May 2025		100	ft trenching		60	Material Deliveries	
		1,754	cy excavation		146	trucks of dirt hauled out	
		1,169	cy asphalt		97	asphalt trucks	
		585	cy gravel		49	trucks of gravel hauled in	
		2,631	SY grading				
Construct flight simulator facility		52,052	sf		10	months construction	
Oct 2024 - Aug 2025		3,856	cy excavation		321	trucks of dirt hauled out	
		2,570	cy concrete		286	concrete trucks	
		1,285	cy gravel		107	trucks of gravel hauled in	
		100	ft trenching		200	Material Deliveries	
		5,784	SY grading				
Construct parking lot		36,000	sf asphalt		4	months construction duration	
Oct 2024 - Aug 2025		4,000	sy grading				
		2,000	cy excavation		167	trucks of dirt hauled out	
		1,333	CY asphalt		111	trucks of asphalt brought in	
		667	cy gravel		56	trucks of gravel hauled in	
Demo 2977, 2978, 1454 & 1406		118,248	sf bldg		2	month demolition	
Assume 1 CY construction debris per 20 SF of building							
		5,912	CY demolition debris		493	Truck loads demolition debris	
Demolish 3005		34,776	sf bldg		1	month demolition	
Assume 1 CY construction debris per 20 SF of building							
		1,739	CY demolition debris		145	Truck loads demolition debris	
					average passenger vehicle		
					404	grams of CO2 per mile	
					0.89	lb of CO2 per mile	
CO2 emissions	2,877		6,464,704	miles			
			562	cars driving 11,500 miles per year			
	3563		8,006,167	miles			
			696	cars driving 11,500 miles per year			

Total Truck Trips	
Dirt	2,024
Concrete	613
Gravel	675
Asphalt	1,117
Demo Debris	638
Materials Delivery	1,120
Grand Total Truck Trips	6,187
Ave # Truck Trip/Day	25

parking for	150		
sidewalks	344	sf	
piles	25219	ft	
5,513			
Excavation	24,293	cy	

CY material brought in	CY material taken out
25,578	31,944

Trenching area SF	3,350
Material removed	93
Total new Bldg SF	217,680
area to be graded SF	351,335
area to be graded SY	39,037
excavation CY	23,626
bldg demo CY	7,651
bldg demo SF	153,024
Paving area	59,681

				average passenger vehicle		
				404	grams of CO2 per mile	
				0.89	lb of CO2 per mile	
CO2 emissions	1,339		3,007,960	miles		
			262	cars driving 11,500 miles per year		

AIRCRAFT EMISSIONS

Aircraft Emissions

UH-1N Operations	UH-1N Emissions (in lbs/op unless noted in left column)					
	Fuel Used	THC	CO	NOx	PM2.5[1]	CO_2
	From AESO LTO Report 9904C					
LTO Cycle	280.4	0.672	3.316	1.280	1.178	893.3
Cruise (lbs/hr)	692.4	0.090	0.699	4.009	2.908	2220.7
Maintenance Test (lb/yr)	5218.7	21.742	99.858	20.864	21.918	16542.2
	From AESO MO Report 9962B					
Rocks & Block	137.7	0.028	0.391	0.714	0.578	441.3
Stop & Go	52.7	0.017	0.249	0.251	0.221	168.6
Touch & Go	37.7	0.007	0.125	0.188	0.158	120.7
Ground Controlled Approach Box	106.0	0.020	0.365	0.518	0.445	339.7
Insertion and Extraction Rig	73.1	0.012	0.151	0.395	0.307	234.2
Pad Landing	49.3	0.008	0.130	0.255	0.207	157.9
Mountain Pad	65.2	0.014	0.231	0.324	0.274	208.9
Auto Rotation	39.6	0.041	0.236	0.197	0.166	126.7
Hoist/Rappel	101.6	0.019	0.250	0.541	0.427	325.8
Search and Rescue	101.6	0.019	0.250	0.541	0.427	325.8
Field Carrier Landing Pract	52.7	0.017	0.249	0.251	0.221	168.6

[1] PM2.5 = PM10

[1]Touch and goes = Standard Pattern, Tactical Low Altitude, Tactical High-Speed, Tail Rotor/Boost Off

[2]Autorotation = 90° and 180° auto-rotation

[3]Special Personnel Insertion= Confined Air Landing (CAL)

[4]Host/Rappel= External Load

[5]Mountain Pad= Pinnacle

Aircraft Emissions

UH-1N Operations	Scaling Factor from UH-1N data, Normalized by LTO Emissions					
	Fuel Used	THC	CO	NOx	PM2.5 [1]	CO_2
LTO Cycle	1.00	1.00	1.00	1.00	1.00	1.00
Cruise (lbs/hr)	2.47	0.13	0.21	3.13	2.47	2.49
Maintenance Test (lb/yr)	18.61	32.37	30.12	16.30	18.61	18.52
Rocks & Block	0.49	0.04	0.12	0.56	0.49	0.49
Stop & Go	0.19	0.03	0.07	0.20	0.19	0.19
Touch & Go	0.13	0.01	0.04	0.15	0.13	0.14
Ground Controlled Approach Box	0.38	0.03	0.11	0.40	0.38	0.38
Insertion and Extraction Rig	0.26	0.02	0.05	0.31	0.26	0.26
Pad Landing	0.18	0.01	0.04	0.20	0.18	0.18
Mountain Pad	0.23	0.02	0.07	0.25	0.23	0.23
Auto Rotation	0.14	0.06	0.07	0.15	0.14	0.14
Hoist/Rappel	0.36	0.03	0.08	0.42	0.36	0.36
Search and Rescue	0.36	0.03	0.08	0.42	0.36	0.36
Field Carrier Landing Pract	0.19	0.03	0.07	0.20	0.19	0.19

Aircraft Emissions						
	Derived[3] TH-57 Emissions (in lbs/op unless noted in left column)					
UH-1N Operations	Fuel Used[2]	VOC	CO	NOx	PM2.5 [1]	CO_2
LTO Cycle	44.5	1.665	2.185	0.134	0.006	140.1
Cruise (lbs/hr)	109.8	0.223	0.461	0.420	0.015	348.3
Maintenance Test (lb/yr)	827.3	53.878	65.816	2.188	0.111	2594.6
Rocks & Block	21.8	0.069	0.257	0.075	0.003	69.2
Stop & Go	8.3	0.042	0.164	0.026	0.001	26.4
Touch & Go	6.0	0.018	0.082	0.020	0.001	18.9
Ground Controlled Approach Box	16.8	0.051	0.240	0.054	0.002	53.3
Insertion and Extraction Rig	11.6	0.030	0.100	0.041	0.002	36.7
Pad Landing	7.8	0.021	0.086	0.027	0.001	24.8
Mountain Pad	10.3	0.036	0.152	0.034	0.001	32.8
Auto Rotation	6.3	0.102	0.156	0.021	0.001	19.9
Hoist/Rappel	16.1	0.046	0.165	0.057	0.002	51.1
Search and Rescue	16.1	0.046	0.165	0.057	0.002	51.1
Field Carrier Landing Pract	8.3	0.042	0.164	0.026	0.001	26.4

Aircraft Emissions						
	Derived[3] UH-72 Emissions (in lbs unless noted in left column)					
UH-1N Operations	Fuel Used[2]	VOC	CO	NOx	PM2.5 [1]	CO_2
LTO Cycle	100.0	3.331	4.368	0.365	0.015	315.3
Cruise (lbs/hr)	247.0	0.446	0.921	1.143	0.036	783.8
Maintenance Test (lb/yr)	1861.7	107.803	131.541	5.948	0.271	5838.7
Rocks & Block	49.1	0.137	0.515	0.204	0.007	155.8
Stop & Go	18.8	0.084	0.327	0.071	0.003	59.5
Touch & Go	13.4	0.036	0.165	0.054	0.002	42.6
Ground Controlled Approach Box	37.8	0.101	0.480	0.148	0.005	119.9
Insertion and Extraction Rig	26.1	0.061	0.199	0.113	0.004	82.7
Pad Landing	17.6	0.041	0.171	0.073	0.003	55.7
Mountain Pad	23.3	0.071	0.304	0.092	0.003	73.7
Auto Rotation	14.1	0.205	0.311	0.056	0.002	44.7
Hoist/Rappel	36.3	0.093	0.330	0.154	0.005	115.0
Search and Rescue	36.3	0.093	0.330	0.154	0.005	115.0
Field Carrier Landing Pract	18.8	0.084	0.327	0.071	0.003	59.5

Baseline Operations – TH-57

Whiting Field South

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	32349	53,850	70,697	4,344	192	4,532,290	3,192
Touch & Go[1]	11835	212	976	234	9	224,035	157
Annual Subtotal in lbs		54,062	71,673	4,578	202	4,756,325	3,349
Annual Total in Tons		27.0	35.8	2.3	0.1	2,378.2	2

NOLF Harold

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	2,829	4,709	6,183	380	17	396,360	279
Cruise	2,829	132	272	248	9	205,638	144
Touch & Go[1]	8,509	153	702	168	7	161,074	113
Auto Rotation[2]	13,090	1,339	2,036	270	11	260,110	182
Spec. Personnel Insertion[3]	2,269	69	226	94	4	83,359	58
Hoist/Rappel[4]	2,269	105	374	129	5	115,944	81
Pad Landing[6]	54,176	1,118	4,645	1,448	57	1,342,068	939
Mountain Pad[5]	2,269	81	345	77	3	74,330	52
Annual Subtotal in lbs		7,706	14,784	2,814	111	2,638,884	1,849
Annual Total in Tons		**3.9**	**7.4**	**1.4**	**0.1**	**1319.4**	**0.9**

NOLF Pace

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	3,094	5,150	6,762	415	18	433,488	305
Cruise	3,094	198	409	373	13	309,239	216
Touch & Go[1]	6,188	111	510	122	5	117,138	82
Pad Landing[6]	92,819	1,916	7,958	2,481	97	2,299,347	1,609
Auto Rotation[2]	24,752	2,533	3,851	511	21	491,845	345
Annual Subtotal in lbs		9,908	19,490	3,903	154	3,651,057	2,558
Annual Total in Tons		**5.0**	**9.7**	**2.0**	**0.1**	**1,825.5**	**1.3**

NOLF Santa Rosa

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	5,039	8,388	11,012	677	30	705,942	497
Cruise	5,039	235	485	442	15	366,255	256
Touch & Go[1]	31,393	563	2,589	620	25	594,264	416
Pad Landing[6]	128,199	2,646	10,991	3,426	134	3,175,800	2,223
Auto Rotation[2]	35,154	3,597	5,469	725	30	698,552	490
Annual Subtotal in lbs		15,429	30,546	5,891	234	5,540,814	3,882
Annual Total in Tons		**7.7**	**15.3**	**2.9**	**0.1**	**2,770.4**	**1.9**

NOLF Spencer

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	6,413	10,675	14,015	861	38	898,500	633
Cruise	6,413	336	694	633	22	524,426	367
Touch & Go[1]	51,304	921	4,232	1,014	41	971,176	680
Pad Landing[6]	153,915	3,177	13,196	4,114	161	3,812,841	2,669
Auto Rotation[2]	51,304	5,250	7,982	1,059	43	1,019,457	715
Annual Subtotal in lbs		20,359	40,118	7,680	305	7,226,401	5,064
Annual Total in Tons		**10.2**	**20.1**	**3.8**	**0.2**	**3613.2**	**2.5**

Baseline Operations – TH-57

NOLF Site 8

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	3,408	5,673	7,447	458	20	477,439	336
Cruise	3,408	476	983	897	31	743,110	520
Touch & Go[1]	10,008	180	825	198	8	189,458	133
Spec. Personnel Insertion[3]	2,129	65	212	88	3	78,225	55
Pad Landing[6]	32,798	677	2,812	877	34	812,487	569
Auto Rotation[2]	9,371	959	1,458	193	8	186,201	131
Annual Subtotal in lbs		8,029	13,738	2,711	105	2,486,920	1,743
Annual Total in Tons		**4.0**	**6.9**	**1.4**	**0.1**	**1,243**	**0.9**

NOLF Choctaw

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	617	1,026	1,348	83	4	86,392	61
Cruise	617	50	104	95	3	78,438	47
Pad Landing[6]	7,395	153	634	198	8	183,186	98
Annual Subtotal in lbs		1,229	2,085	375	15	348,015	206
Annual Total in Tons		**0.6**	**1.0**	**0.2**	**0.0**	**174**	**0.1**

Baseline Annual Emission Totals

Location	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
Whiting Field South	27.0	35.8	2.3	0.1	2,378	1.7
NOLF Harold	3.9	7.4	1.4	0.1	1,319	0.9
NOLF Pace	5.0	9.7	2.0	0.1	1,826	1.3
NOLF Santa Rosa	7.7	15.3	2.9	0.1	2,770	1.9
NOLF Spencer	10.2	20.1	3.8	0.2	3,613	2.5
NOLF Site 8	4.0	6.9	1.4	0.1	1,243	0.9
NOLF Choctaw	0.6	1.0	0.2	0.0	174	0.1
Total	**58**	**96**	**14**	**1**	**13,324**	**9**

No Action Alternative Operations – TH-57

Whiting Field

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	32349	53,850	70,697	4,344	192	4,532,290	3,192
Touch & Go[1]	11834	212	976	234	9	224,035	157
Annual Subtotal in lbs		54,062	71,673	4,578	202	4,756,325	3,349
Annual Total in Tons		**27.0**	**35.8**	**2.3**	**0.1**	**2,378.2**	**2**

NOLF Harold

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	1,994	3,319	4,358	268	12	279,371	197
Cruise	1,994	93	192	175	6	144,943	101
Touch & Go[1]	6,000	108	495	119	5	113,579	80
Auto Rotation[2]	9,230	944	1,436	190	8	183,409	129
Spec. Personnel Insertion[3]	1,600	49	159	66	2	58,781	41
Hoist/Rappel[4]	1,600	74	264	91	3	81,759	57
Pad Landing[6]	38,203	33	137	43	2	39,636	662
Mountain Pad[5]	1,600	57	243	54	2	52,414	37
Annual Subtotal in lbs		4,677	7,285	1,006	40	953,892	1,304
Annual Total in Tons		**2.3**	**3.6**	**0.5**	**0.0**	**476.9**	**0.7**

NOLF Pace

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	2,991	4,979	6,537	402	18	419,057	295
Cruise	2,991	191	396	361	13	298,944	209
Touch & Go[1]	5,981	107	493	118	5	113,219	79
Pad Landing[6]	89,722	123	513	160	6	148,164	1,556
Auto Rotation[2]	23,926	2,448	3,722	494	20	475,432	334
Annual Subtotal in lbs		7,849	11,661	1,534	61	1,454,816	2,473
Annual Total in Tons		**3.9**	**5.8**	**0.8**	**0.0**	**727.4**	**1.2**

NOLF Santa Rosa

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	4,982	8,293	10,887	669	30	697,956	492
Cruise	4,982	232	479	437	15	362,111	253
Touch & Go[1]	31,032	557	2,560	613	25	587,431	411
Pad Landing[6]	126,726	2,616	10,865	3,387	132	3,139,311	2,197
Auto Rotation[2]	34,750	3,556	5,406	717	29	690,524	484
Annual Subtotal in lbs		15,253	30,197	5,823	231	5,477,333	3,838
Annual Total in Tons		**7.6**	**15.1**	**2.9**	**0.1**	**2,738.7**	**1.9**

NOLF Spencer

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	5,981	9,956	13,071	803	36	837,974	590
Cruise	5,981	313	647	590	21	489,099	342
Touch & Go[1]	47,852	859	3,947	946	38	905,831	634
Pad Landing[6]	143,555	2,963	12,308	3,837	150	3,556,199	2,489
Auto Rotation[2]	47,852	4,896	7,444	987	40	950,863	667
Annual Subtotal in lbs		18,988	37,418	7,163	284	6,739,966	4,723
Annual Total in Tons		**9.5**	**18.7**	**3.6**	**0.1**	**3370.0**	**2.4**

No Action Alternative Operations – TH-57

NOLF Site X

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	3,589	5,974	7,844	482	21	502,841	354
Cruise	3,589	251	518	472	16	391,323	274
Touch & Go[1]	23,255	417	1,918	460	19	440,213	308
Auto Rotation[2]	15,788	1,615	2,456	326	13	313,722	220
Spec. Personnel Insertion[3]	4,096	124	408	170	6	150,480	105
Hoist/Rappel[4]	205	10	34	12	0	10,475	7
Pad Landing[6]	56975	1,176	4,885	1,523	59	1,411,406	988
Mountain Pad[5]	4,096	145	623	139	6	134,181	94
Annual Subtotal in lbs		9,713	18,686	3,583	142	3,354,641	2,351
Annual Total in Tons		**4.9**	**9.3**	**1.8**	**0.1**	**1,677**	**1.2**

NOLF Choctaw

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	399	664	872	54	2	55,902	39
Cruise	399	33	67	61	2	50,755	36
Pad Landing[6]	4,785	99	410	128	5	118,536	83
Annual Subtotal in lbs		795	1,349	243	10	225,193	158
Annual Total in Tons		**0.4**	**0.7**	**0.1**	**0.0**	**113**	**0.1**

No Action Alternative Annual Emission Totals

Location	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
Whiting Field South	27.0	35.8	2.3	0.1	2,378	1.7
NOLF Harold	2.3	3.6	0.5	0.0	477	0.7
NOLF Pace	3.9	5.8	0.8	0.0	727	1.2
NOLF Santa Rosa	7.6	15.1	2.9	0.1	2,739	1.9
NOLF Spencer	9.5	18.7	3.6	0.1	3,370	2.4
NOLF Site X	4.9	9.3	1.8	0.1	1,677	1.2
NOLF Choctaw	0.4	0.7	0.1	0.0	113	0.1
Total	**56**	**89**	**12**	**0**	**11,481**	**9**

Proposed Action – AHTS (UH-72 used as surrogate)

Whiting Field South

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	39465	131,449	172,379	14,403	574	12,442,862	8,764
Touch & Go[1]	14438	518	6,506	2,120	77	1,681,165	431
Annual Subtotal in lbs		131,967	178,885	16,523	651	14,124,026	9,195
Annual Total in Tons		**66.0**	**89.4**	**8.3**	**0.3**	**7,062.0**	**5**

NOLF Harold

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	2,433	8,104	10,627	888	35	767,097	540
Cruise	2,433	113	234	214	7	176,853	124
Touch & Go[1]	7,320	263	1,207	393	14	311,824	218
Auto Rotation[2]	11,262	2,306	3,502	632	23	503,599	353
Spec. Personnel Insertion[3]	1,952	119	389	220	7	161,380	113
Hoist/Rappel[4]	1,952	181	644	301	10	224,463	157
Mountain Pad[5]	1,952	139	594	180	7	143,900	101
Pad Landing[6]	46,609	1,925	7,987	3,386	119	2,598,297	1,819
Annual Subtotal in lbs		11,224	17,196	2,827	105	2,289,116	1,606
Annual Total in Tons		**5.6**	**8.6**	**1.4**	**0.1**	**1144.6**	**0.8**

NOLF Pace

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	3,649	12,154	15,938	1,332	53	1,150,488	810
Cruise	3,649	234	483	440	15	364,710	255
Touch & Go[1]	7,298	262	1,203	392	14	310,887	218
Auto Rotation[2]	29,190	5,976	9,076	1,637	60	1,305,279	916
Pad Landing[6]	109,464	4,521	18,757	7,951	280	6,102,254	4,271
Annual Subtotal in lbs		23,147	45,458	11,753	422	9,233,617	6,470
Annual Total in Tons		**11.6**	**22.7**	**5.9**	**0.2**	**4,616.8**	**3.2**

NOLF Santa Rosa

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	6,081	20,254	26,561	2,219	88	1,917,270	1,350
Cruise	6,081	283	585	534	19	442,024	309
Touch & Go[1]	37,887	1,360	6,246	2,035	74	1,613,944	1,130
Auto Rotation[2]	42,426	8,686	13,192	2,379	87	1,897,148	1,331
Pad Landing[6]	154,714	6,390	26,511	11,238	395	8,624,792	6,037
Annual Subtotal in lbs		36,974	73,094	18,406	663	14,495,177	10,157
Annual Total in Tons		**18.5**	**36.5**	**9.2**	**0.3**	**7,247.6**	**5.1**

NOLF Spencer

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	7,298	24,308	31,877	2,663	106	2,300,976	1,621
Cruise	7,298	382	790	720	25	596,798	418
Touch & Go[1]	58,380	2,096	9,624	3,136	114	2,486,922	1,741
Auto Rotation[2]	58,380	11,952	18,152	3,274	120	2,610,558	1,831
Pad Landing[6]	175,140	7,234	30,011	12,722	447	9,763,473	6,834
Annual Subtotal in lbs		45,973	90,454	22,516	812	17,758,727	12,444
Annual Total in Tons		**23.0**	**45.2**	**11.3**	**0.4**	**8879.4**	**6.2**

Proposed Action – AHTS (UH-72 used as surrogate)

NOLF Site X

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	4,380	14,589	19,131	1,598	64	1,380,964	973
Cruise	4,380	306	632	577	20	477,569	334
Touch & Go[1]	28,371	1,019	4,677	1,524	55	1,208,573	846
Spec. Personnel Insertion[3]	4,998	303	996	563	19	413,205	289
Auto Rotation[2]	19,260	3,943	5,989	1,080	40	861,243	604
Hoist/Rappel[4]	250	23	82	39	1	28,748	20
Mountain Pad[5]	4,998	355	1,520	461	17	368,450	258
Pad Landing[6]	69,510	2,871	11,911	5,049	178	3,874,952	2,712
Annual Subtotal in lbs		23,409	44,937	10,891	393	8,613,702	6,037
Annual Total in Tons		**11.7**	**22.5**	**5.4**	**0.2**	**4,307**	**3.0**

NOLF Choctaw

Operation	# ops	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
LTO	487	1,622	2,127	178	7	153,546	108
Cruise	487	40	82	75	3	61,949	43
Pad Landing[6]	5,837	241	1,000	424	15	325,393	228
Annual Subtotal in lbs		1,903	3,209	677	25	540,888	379
Annual Total in Tons		**1.0**	**1.6**	**0.3**	**0.0**	**270**	**0.2**

Location	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
Whiting Field South	66.0	89.4	8.3	0.3	7062.0	4.6
NOLF Harold	5.6	8.6	1.4	0.1	1144.6	0.8
NOLF Pace	11.6	22.7	5.9	0.2	4616.8	3.2
NOLF Santa Rosa	18.5	36.5	9.2	0.3	7247.6	5.1
NOLF Spencer	23.0	45.2	11.3	0.4	8879.4	6.2
NOLF Site X	11.7	22.5	5.4	0.2	4306.9	3.0
NOLF Choctaw	1.0	1.6	0.3	0.0	270.4	0.2
Total	**137**	**227**	**42**	**2**	**33,528**	**23**

Engine Maintenance Testing at Whiting Field South

Action	# tests/yr	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
Baseline	3,818	103	126	4	0	4,353	4
No Action	3,818	103	126	4	0	4,353	4
Proposed Action	4,668	252	307	14	1	13,629	10

Additional Personnel (with family = 1.2 people on average)

	# vehicles	# days	mi/day	VOC lb/mi	CO lb/mi	NOx lb/mi	SO2 lb/mi	PM10 lb/mi	PM2.5 lb/mi	CO_2 lb/mi
annually	40	350	60	0.0005465	0.004718	0.000437157	1.072E-05	#######	6.3E-05	1.10
				VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	CO_2 lb
				455	3924	364	9	79	52	318,886
			POV Grand Total in Tons	**0.23**	**1.96**	**0.18**	**0.00**	**0.04**	**0.03**	
			POV Total in Metric Tons							**417**

Action	VOC	CO	NOx	PM10/ PM2.5	CO2	SO2
Baseline	160	220	17	1	17,163	12
No Action Alternative	158	214	15	1	15,565	12
Preferred Alternative	388	534	55	2	46,097	32
Comparative Threshold	100	100	100	100	NA	100
Net Change from Baseline	228	314	38	1	28,933	20
Exceed Comparable Threshold	Yes	Yes	No	No	NA	No
Net Change from No Action	231	321	39	1	30532	20
Exceed Comparable Threshold	Yes	Yes	No	No	NA	No

				average passenger vehicle	
				404	grams of CO2 per mile
				0.89	lb of CO2 per mile
CO2 emissions	30,532		68,605,431	miles	
			5,966	cars driving 11,500 miles per year	