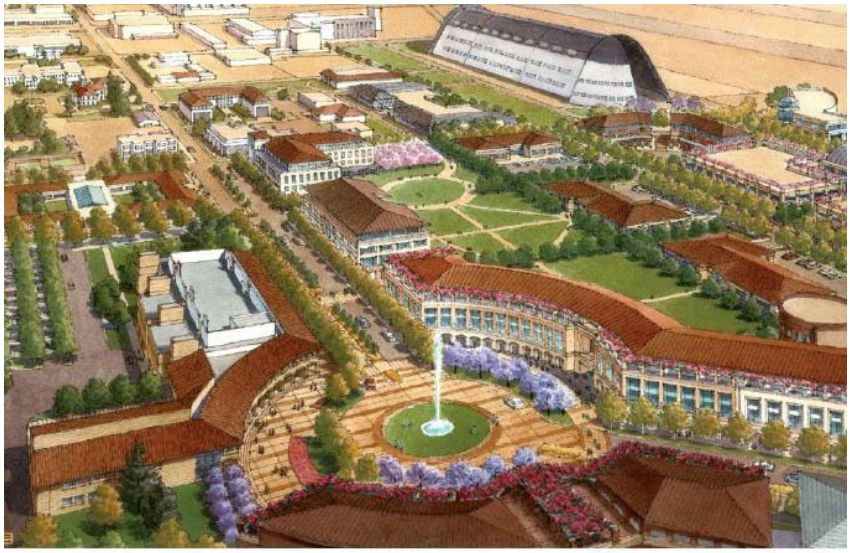
NASA Ames Development Plan

Final Programmatic

Environmental Impact Statement



Appendix D: Air Quality Appendix and General Conformity Determination for Carbon Monoxide

Nasa Ames Research Center

July 2002

design, community & environment

NASA AMES DEVELOPMENT PLAN

FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D

NASA AMES RESEARCH CENTER

JULY 2002

MANAGED BY

DANIEL, MANN, JOHNSON & MENDENHALL

394 PACIFIC AVENUE, THIRD FLOOR — TEL: 415 986 1373

SAN FRANCISCO, CALIFORNIA 94111-1718 — FAX: 415 986 4886

PREPARED BY

DESIGN, COMMUNITY & ENVIRONMENT

1600 SHATTUCK AVENUE, SUITE 222 — TEL: 510 848 3815

BERKELEY, CALIFORNIA 94709 — FAX: 510 848 4315

in association with

FEHR & PEERS ASSOCIATES, INC.

NELSON NYGAARD

ILLINGWORTH & RODKIN

JONES & STOKES

DR. LYNNE TRULIO

BRIAN KANGAS FOULK

BAY AREA ECONOMICS

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APPENDIX D I

GENERAL CONFORMITY DETERMINATION FOR CARBON MONOXIDE

NASA AMES RESEARCH CENTER, MOFFETT FIELD, CALIFORNIA

General Conformity Determination for Carbon Monoxide
NASA Ames Development Plan

Section 176(c) of the Clean Air Act Amendments requires Federal agencies to assure that their actions conform to applicable plans for achieving and maintaining the National Ambient Air Quality Standards (NAAQS). The primary oversight responsibility for assuring conformity is assigned to the Federal agency. The following findings are made regarding the conformity determination statement under the federal Clean Air Act with respect to the Proposed Action.

1. The Proposed Action is the build out of Mitigated Alternative 5 described in the Final EIS for the NASA Ames Development Plan.

2. The Proposed Action is located in the Bay Area Air Quality Management District (BAAQMD), which is designated by the EPA as a maintenance area for the national carbon monoxide standard.

3. The Proposed Action, built out over a period of 11 or more years, would result in maximum annual total direct and indirect emissions of carbon monoxide that exceed 100 tons per year. These emissions exceed the *de minimus* amounts specified in the General Conformity Rule (40 CFR 51), thus requiring a conformity determination.

4. The air quality analysis presented in Part D2 of this Appendix D, conducted for the Proposed Action, indicates that predicted carbon monoxide concentrations associated with the project would not cause or contribute to any new violation of the NAAQS for carbon monoxide or increase the frequency or severity of any existing violation of the carbon monoxide NAAQS. Results of the CO dispersion modeling are included in Table 4.4-9 of the Final EIS.

5. Pursuant to Section 176(c) of the Clean Air Act (42 U.S.C. 7476(c)), NASA has determined that implementation of the Proposed Action (Alternative 5) will conform to the Bay Area Air Quality Management District (BAAQMD) State Implementation Plan for Carbon Monoxide. The applicable state implementation plan for carbon monoxide is the Bay Area Redesignation Request and Maintenance Plan for the National Carbon Monoxide Standard, approved by the EPA on June 1, 1998.

_____ _____

Signature Date
Dr. Henry McDonald
Director

HOT SPOT ANALYSIS

CO Hot Spot Analysis Description

To assess local air quality impacts, carbon monoxide (CO) concentrations were modeled at congested intersections substantially affected by the project. Total emission calculations indicate that project-related emissions of CO will exceed the General Conformity *de minimus* levels of 91 metric tons per year (100 tons per year). Therefore, a conformity determination would be needed to address the potential for CO concentrations that violate the National Ambient Air Quality Standards (NAAQS).

Hot spot CO screening modeling was conducted for eight of the most congested intersections that would be affected by traffic from the proposed project. The screening procedure was based on the methodology recommended by the BAAQMD. [1]

At the Moffett Boulevard/R.T. Jones Road intersection, a more detailed study was warranted by the results of the screening and was therefore conducted. This refined modeling analysis was conducted using the CALINE4 model following the Transportation Project-Level Carbon Monoxide Protocol.[2] This protocol includes two screening level methods and a refined level of analysis.

CO concentrations were predicted at intersections where a combination of poor level of service (i.e., LOS D, E, or F) and a substantial effect by the project is predicted (approximately 5 percent of traffic). The BAAQMD screening method was the first level of analysis. Where CO levels that exceeded the standards were predicted, the refined analysis for that intersection using the CALINE4 model was conducted. The BAAQMD procedure used predicted peak AM and PM traffic levels and slow speed emission factors (15 kilometer per hour or 10 mph). Receptors were located at the edge of roadway except for expressway or major arterials (Central Expressway and Mathilda) where receptors were located 25 feet from the roadway. Dispersion coefficients recommended by the BAAQMD were used based on the number of lanes for major movements.

In both the screening and the detailed analysis, the CALINE4 model was used to predict 8-hour CO concentrations for comparison to the NAAQS of 9 parts per million (ppm) and the CAAQS of 9.0 ppm. This model is the latest in a series of line source air quality models that can characterize pollutant dispersion from roadways and intersections. Inputs to the model are source strength (emission rate and traffic volume), meteorological conditions, proximity of receptor locations to roadways, and site characteristics. As with all Gaussian models, a number of supporting assumptions limit the ability of CALINE4 to fully describe the physical conditions of the source and the atmosphere. Because some of the processes that disperse pollutants are not fully understood, the model has been designed to conservatively estimate downwind pollutant dispersion. That is, the estimates of downwind concentrations provided by CALINE4 tend to be greater than actual measured concentrations. In addition, several worst-case assumptions were used with the model to ensure conservative estimates of project impacts. The most conservative assumption included employing a persistent worst-case wind angle and low wind speed, where the wind is assumed to blow for a full hour in the direction that would result in the highest concentration. Other assumptions used in this analysis include:

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[1] BAAQMD, *CEQA Guidelines*, 1996, revised 1999, pp. 36-46.

[2] University of California, Davis, 1997. *Transportation Project-Level Carbon Monoxide Protocol*. Institute of Transportation Studies. December.

- worst-case wind angle search
- wind speed of 1 meter per second
- sigma theta of 10°
- mixing height 1,000 meters, and atmospheric stability of category F
- ambient temperature of 7°C (45°F)

Emission factors that are used in the CALINE4 model were developed with the EMFAC7Fv1.1 model, using the vehicle mix representative of Santa Clara County traffic and wintertime operating conditions. This model was developed by the California ARB. Although this model has been updated, EPA and the ARB still require use of EMFAC7v1.1 as part of the CO dispersion modeling for CO conformity determinations. The EMFAC7v1.1 performs better for predicting tailpipe emissions that are used in dispersion modeling than the newer emissions models that are designed to predicted emissions for uses in establishing state or county emissions inventories. Key inputs used in EMFAC7v1.1 include:

- Cold start percentage of up to 40% for PM fringe area traffic (near NASA)
- Cold start percentage of 15% for PM Expressway and AM fringe area traffic
- Temperature of 7°C (45°F)

Carbon monoxide concentrations are typically highest in the evening periods, especially near large sources of automobile trips. This is due to a combination of factors that include higher traffic volumes, meteorological conditions, and emissions from traffic combining with wood smoke. In addition, a higher percentage of commuter vehicles near NASA are in what is referred to as Acold-start@ mode where carbon monoxide emissions are considerably higher. After these vehicles have been operating for a few minutes, carbon monoxide emissions decrease substantially. Carbon monoxide emissions are higher during cold-start mode, since cold fuel is not efficiently combusted and catalytic converters in the exhaust line must heat up to reduce emissions effectively.

The CALINE4 model predicts a one-hour level that was converted to an 8-hour level using a persistence factor of 0.7. Background 8-hour concentrations were determined using 8-hour CO background concentrations reported in Figure 4 of the BAAQMD CEQA Guidelines. These concentrations were adjusted for future years using the rollback factors contained in Table 13 of the CEQA Guidelines. Use of this method indicates background CO levels of 5.3 ppm in the year 2000 and 4.1 ppm for the year 2010 and beyond.

The total predicted 8-hour concentration was calculated by adding the modeled 8-hour CO level to the appropriate background 8-hour levels. For conformity determinations, predicted CO concentrations are compared to the 8-hour CO NAAQS (9 ppm or 9.4 ppm) to determine if the project conforms to the SIP. A project with a maximum predicted 8-hour CO concentration that is less than or equal to 9.4 ppm would be considered to conform with the SIP. A predicted 8-hour CO concentration caused by the project that exceeds the California Ambient Air Quality Standard of 9.0 ppm would be considered a significant impact.

NASA AMES DEVELOPMENT PLAN EIS
CARBON MONOXIDE SCREENING ANALYSIS

Intersection	Lanes	Traffic Volume Exist	Alt 1	Alt 2	Alt. 3	Alt 4	Alt 5	1-Hour CO Contribution Alt 1	Alt 2	Alt. 3	Alt 4	Alt 5	Total 1-Hour CO Concentration Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Total 8-Hour CO Concentration Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Link: #1 Middlefield/Shoreline																						
PM													**13**	**13**	**13**	**13**	**13**	**8.3**	**8.3**	**8.3**	**8.3**	**8.3**
Shoreline (west)	4	2628	3281	3281	3281	3281	3281	5.0	5.0	5.0	5.0	5.0										
Middlefield (south)	4	1849	2457	2503	2501	2519	2480	1.0	1.1	1.1	1.1	1.0										
AM													**11**	**11**	**11**	**11**	**11**	**7.2**	**7.2**	**7.2**	**7.2**	**7.2**
Shoreline (east)	4	2545	3200	3200	3200	3200	3200	3.7	3.7	3.7	3.7	3.7										
Middlefield (south)	4	1727	2312	2352	2350	2366	2325	0.8	0.8	0.8	0.8	0.8										
Link: #2Moffett/Central Expressway																						
PM													**12**	**12**	**12**	**12**	**12**	**7.3**	**7.4**	**7.4**	**7.4**	**7.3**
Moffett (west)	4	1200	1772	1886	1881	1926	1829	0.7	0.8	0.8	0.8	0.8										
Central Expressway (north)*	4	3169	4332	4378	4376	4394	4355	3.9	3.9	3.9	3.9	3.9										
AM													**10**	**10**	**10**	**10**	**10**	**6.4**	**6.5**	**6.5**	**6.5**	**6.4**
Moffett (west)	4	954	1482	1581	1590	1617	1517	0.5	0.5	0.5	0.5	0.5										
Central Expressway (north)*	4	3081	4213	4253	4250	4267	4226	2.9	2.9	2.9	2.9	2.9										
Link: #3 Moffett/Middlefield																						
PM													**12**	**12**	**12**	**12**	**12**	**7.4**	**7.7**	**7.7**	**7.8**	**7.6**
Moffett (east)	4	2195	2739	2985	2981	3097	2890	4.2	4.5	4.5	4.7	4.4										
Middlefield (south)	4	1297	1924	2035	2011	2082	1965	0.6	0.7	0.7	0.7	0.7										
AM													**9**	**9**	**9**	**9**	**9**	**5.7**	**5.7**	**5.7**	**5.8**	**5.7**
Moffett (west)	4	1943	2562	2714	2720	2775	2615	0.8	0.9	0.9	0.9	0.8										
Middlefield (south)	4	1443	2094	2200	2220	2242	2120	1.4	1.5	1.5	1.5	1.5										
Link: #7 Moffett-Clark/Moffett Ext																						
		PM Modeled using Caline4						***3.0***	***5.1***	***5.5***	***6.5***	***4.7***	***10***	***12***	***12***	***13***	***12***	***6.2***	***7.6***	***7.9***	***8.6***	***7.4***
PM													**12**	**15**	**15**	**17**	**14**	**7.8**	**9.9**	**9.6**	**11.1**	**9.0**
Moffett-Clark (north)	4	1428	2353	3676	3625	4285	3149	4.6	7.2	7.1	8.4	6.2										
Moffett Ext. (east)	2	633	1140	1721	1140	2530	1334	0.8	1.1	0.8	1.7	0.9										
AM													**9**	**11**	**11**	**12**	**10**	**5.7**	**6.7**	**6.7**	**7.3**	**6.1**
Moffett-Clark	4	1217	1831	2929	2930	3456	2321	2.1	3.4	3.4	4.0	2.7										
Moffett Ext.	2	470	544	1138	1000	1825	709	0.2	0.3	0.3	0.5	0.2										
Link: #8 Whisman/Middlefield																						
PM													**11**	**11**	**11**	**11**	**11**	**7.0**	**7.1**	**7.0**	**7.2**	**7.0**
Whisman (west)	4	889	1159	1159	1159	1159	1159	0.5	0.5	0.5	0.5	0.5										
Middlefield (north)	4	1781	2428	2540	2428	2586	2469	3.7	3.9	3.7	3.9	3.7										
AM													**10**	**10**	**10**	**10**	**10**	**6.2**	**6.3**	**6.3**	**6.4**	**6.3**
Whisman (west)	4	753	1046	1046	1046	1046	1046	0.3	0.3	0.3	0.3	0.3										
Middlefield (south)	4	1565	2373	2478	2500	2520	2399	2.8	2.9	2.9	3.0	2.8										
Link: #9 Ellis/Middlefield																						
PM													**13**	**13**	**13**	**13**	**13**	**8.0**	**8.3**	**8.4**	**8.4**	**8.2**
Ellis (east)	3	902	1691	1882	1933	1881	1796	0.9	1.0	1.0	1.0	0.9										

10/18/2001

NASA AMES DEVELOPMENT PLAN EIS
CARBON MONOXIDE SCREENING ANALYSIS

Intersection	Lanes	Traffic Volume Exist	Alt 1	Alt 2	Alt. 3	Alt 4	Alt 5	1-Hour CO Contribution Alt 1	Alt 2	Alt. 3	Alt 4	Alt 5	Total 1-Hour CO Concentration Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Total 8-Hour CO Concentration Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Middlefield (south)	4	1869	3135	3378	3431	3409	3281	4.8	5.1	5.2	5.2	5.0										
AM													11	12	12	12	12	7.2	7.4	7.4	7.5	7.3
Ellis (east)	3	959	1738	1894	1895	1896	1796	0.7	0.7	0.7	0.7	0.7										
Middlefield (south)	4	1980	3278	3475	3480	3504	3362	3.8	4.1	4.1	4.1	3.9										
Link: #12 Ellis/Manilla																						
PM													9	10	10	10	9	5.4	6.1	6.1	6.2	5.7
Ellis (west)	4	546	1021	1609	1703	1698	1348	1.6	2.4	2.6	2.6	2.0										
Manilla (south)	2	333	665	803	758	840	684	0.3	0.4	0.4	0.4	0.3										
AM													9	9	9	9	9	5.2	5.7	5.7	5.7	5.4
Ellis (west)	4	607	1238	1724	1750	1811	1427	1.4	2.0	2.0	2.1	1.7										
Manilla	2	229	551	693	700	730	563	0.2	0.3	0.3	0.3	0.2										
Link: #17 237 WB ramps/Mathilda																						
PM													13	13	13	14	13	8.4	8.6	8.5	8.7	8.4
SR 237 WB ramps (west)*	2	380	2305	2434	2374	2465	2305	0.9	0.9	0.9	0.9	0.9										
Mathilda (north)	8	2213	7320	7696	7552	7791	7338	5.3	5.6	5.5	5.7	5.3										
AM													12	12	12	12	12	7.7	7.8	7.8	7.9	7.7
SR 237 WB ramps (east)*	2	806	1668	1761	1770	1788	1670	0.5	0.5	0.5	0.5	0.5										
Mathilda (north)*	8	2772	8268	8668	8700	8768	8280	4.6	4.9	4.9	4.9	4.6										
Link: #18 Manilla-Moffett/Mathilda																						
PM													13	13	13	13	13	8.3	8.5	8.4	8.5	8.3
Manilla-Moffett (west)	4	966	1543	1572	1573	1583	1562	0.6	0.7	0.7	0.7	0.7										
Mathilda (south)*	8	2299	7402	7778	7633	7872	7421	5.4	5.7	5.6	5.7	5.4										
AM													12	13	12	13	12	7.8	8.0	7.9	8.0	7.8
Manilla-Moffett (west)	4	1243	2004	2004	2004	2004	2004	0.7	0.7	0.7	0.7	0.7										
Mathilda (south)*	8	2834	8375	8776	8700	8874	8387	4.7	4.9	4.9	5.0	4.7										

* Receptor distance 25 feet

Emission Factors (EMFAC7Fv1.1 @ 10mph)

Future 15% Cold Start (AM)	2013	=	9.84 g/mi
Future 25% Cold Start (PM)	2013	=	12.76 g/mi
Future 40% Cold Start (PM on site)	2013	=	16.55 g/mi

Background CO Levels

	1-Hour	8-Hour
1992 (from BAAQMD Guidelines)	12	7
2000	9.0	5.3
2013	7.0	4.1

Dispersion Factors (at edge)

Primary	Edge	25 feet
4-Lane	11.9	7.0
6 Lane	9.5	6.1
8 Lane	8.5	5.7
Secondary		
2-Lane	4.0	3.0
4 Lane	3.3	2.6
6 Lane	2.8	2.3
8 Lane	2.6	2.2

* 10/18/2001

Intersection	Lanes	Exist	Alt 1	Alt 2	Alt. 3	Alt 4	Alt 5
				Traffic Volume			
Link: #1 Middlefield/Shoreline							
PM	LOS	E	E	E	E	E	
	% Change			1%	1%	1%	0%
Shoreline (west)	4	2628	3281	3281	3281	3281	3281
Middlefield (south)	4	1849	2457	2503	2501	2519	2480
AM	LOS	E	E	E	E	E	
	% Change			1%	1%	1%	0%
Shoreline (east)	4	2545	3200	3200	3200	3200	3200
Middlefield (south)	4	1727	2312	2352	2350	2366	2325
Link: #2Moffett/Central Expressway							
PM	LOS	E	F	F	F	E	
	% Change			3%	3%	4%	1%
Moffett (west)	4	1200	1772	1886	1881	1926	1829
Central Expressway (north)*	4	3169	4332	4378	4376	4394	4355
AM	LOS	E	E	E	E	E	
	% Change			2%	3%	3%	1%
Moffett (west)	4	954	1482	1581	1590	1617	1517
Central Expressway (north)*	4	3081	4213	4253	4250	4267	4226
Link: #3 Moffett/Middlefield							
PM	LOS	D	E	E	E	D	
	% Change			8%	7%	11%	4%
Moffett (east)		2195	2739	2985	2981	3097	2890
Middlefield (south)		1297	1924	2035	2011	2082	1965
AM	LOS	D	E	E	E	D	
	% Change			6%	6%	8%	2%
Moffett (west)		1943	2562	2714	2720	2775	2615
Middlefield (south)		1443	2094	2200	2220	2242	2120
Link: #7 Moffett-Clark/Moffett Ext							
PM	LOS	F	F	F	F	F	
	% Change			55%	36%	95%	28%
Moffett-Clark (north)		1428	2353	3676	3625	4285	3149
Moffett Ext. (east)		633	1140	1721	1140	2530	1334
AM	LOS	F	F	F	F	F	
	% Change			71%	65%	122%	28%
Moffett-Clark		1217	1831	2929	2930	3456	2321
Moffett Ext.		470	544	1138	1000	1825	709
Link: #8 Whisman/Middlefield							
PM	LOS	C	B	C	B	C	
	% Change			3%	0%	4%	1%
Whisman (west)	4	889	1159	1159	1159	1159	1159
Middlefield (north)	4	1781	2428	2540	2428	2586	2469
AM	LOS	B	B	B	B	B	
	% Change			3%	4%	4%	1%
Whisman (west)	4	753	1046	1046	1046	1046	1046
Middlefield (south)	4	1565	2373	2478	2500	2520	2399
Link: #9 Ellis/Middlefield							
PM	LOS	C	C	C	C	C	

NASA AMES DEVELOPMENT PLAN EIS

Traffic

Intersection	Lanes	Exist	Alt 1	Traffic Volume Alt 2	Alt. 3	Alt 4	Alt 5
	% Change			9%	11%	10%	5%
Ellis (east)	3	902	1691	1882	1933	1881	1796
Middlefield (south)	4	1869	3135	3378	3431	3409	3281
AM	LOS	C	D	D	D	C	
	% Change			7%	7%	8%	3%
Ellis (east)	3	959	1738	1894	1895	1896	1796
Middlefield (south)	4	1980	3278	3475	3480	3504	3362
Link: #12 Ellis/Manilla							
PM	LOS	C	F	E	F	D	
	% Change			43%	46%	51%	21%
Ellis (west)	4	546	1021	1609	1703	1698	1348
Manilla (south)	2	333	665	803	758	840	684
AM	LOS	B	B	B	C	B	
	% Change			35%	37%	42%	11%
Ellis (west)	4	607	1238	1724	1750	1811	1427
Manilla	2	229	551	693	700	730	563
Link: #17 237 WB ramps/Mathilda							
PM	LOS	F	F	F	F	F	
	% Change			5%	3%	7%	0%
SR 237 WB ramps (west)*	2	380	2305	2434	2374	2465	2305
Mathilda (north)	8	2213	7320	7696	7552	7791	7338
AM	LOS	F	F	F	F	F	
	% Change			5%	5%	6%	0%
SR 237 WB ramps (east)*	2	806	1668	1761	1770	1788	1670
Mathilda (north)*	8	2772	8268	8668	8700	8768	8280
Link: #18 Manilla-Moffett/Mathilda							
PM	LOS	F	F	F	F	F	
	% Change			5%	3%	6%	0%
Manilla-Moffett (west)	4	966	1543	1572	1573	1583	1562
Mathilda (south)*	8	2299	7402	7778	7633	7872	7421
AM	LOS	F	F	F	F	F	
	% Change			4%	3%	5%	0%
Manilla-Moffett (west)	4	1243	2004	2004	2004	2004	2004
Mathilda (south)*	8	2834	8375	8776	8700	8874	8387

* Receptor distance 25 feet

Emission Factors (EMFAC7Fv1.1 @ 10mph)

Future 15% Cold Start (AM)	2013	=	9.84 g/mi
Future 25% Cold Start (PM)	2013	=	12.76 g/mi

Background CO Levels	1-Hour	8-Hour
1992 (from BAAQMD Guidelines)	12	7
2000	9.0	5.3
2013	7.0	4.1

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: NASA#7 Moffett/Clark Alt1pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	6 (F)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	10. DEGREES	TEMP=	7.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. MCEBC	250	405	345	489	AG	527	5.7	.0	13.3
B. MCEBA	345	489	465	543	AG	527	16.6	.0	13.3
C. MCEBD	465	543	608	600	AG	304	7.1	.0	13.3
D. MCEBC	608	600	708	636	AG	304	5.7	.0	13.3
E. MCWBC	703	647	606	606	AG	1495	5.7	.0	13.3
F. MCWBA	606	606	464	553	AG	1495	38.3	.0	13.3
G. MCWBD	464	553	342	499	AG	1826	18.3	.0	13.3
H. MCWBC	342	499	241	414	AG	1826	5.7	.0	13.3
I. MENBC	425	331	425	400	AG	64	5.7	.0	13.3
J. MENBA	425	400	471	550	AG	64	15.1	.0	13.3
K. MENBD	471	550	488	630	AG	531	7.4	.0	13.3
L. MENBD	488	630	454	687	AG	531	7.4	.0	13.3
M. MENBC	454	687	447	762	AG	531	5.7	.0	13.3
N. MESBC	440	760	446	693	AG	609	5.7	.0	13.3
O. MESBA	446	693	482	628	AG	609	16.6	.0	13.3
P. MESBA	482	628	460	548	AG	609	16.6	.0	13.3
Q. MESBD	460	548	420	401	AG	34	7.1	.0	13.3
R. MESBC	420	401	417	333	AG	34	5.7	.0	13.3

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: NASA#7 Moffett/Clark Alt1pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. Recpt 1	464	483	1.8
2. Recpt 2	483	537	1.8
3. Recpt 3	488	576	1.8
4. Recpt 4	489	656	1.8
5. Recpt 5	439	678	1.8
6. Recpt 6	467	624	1.8

7. Recpt 7	462	581	1.8
8. Recpt 8	445	560	1.8
9. Recpt 9	442	521	1.8
10. Recpt 10	469	522	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. Recpt 1	3.	1.1	.0	.0	.0	.0	.0	.4	.1	.0
2. Recpt 2	352.	2.0	.0	.0	.0	.0	.0	1.2	.0	.0
3. Recpt 3	230.	2.7	.0	.3	.0	.0	.0	.9	1.0	.0
4. Recpt 4	194.	1.4	.0	.0	.0	.0	.0	.3	.2	.0
5. Recpt 5	126.	1.1	.0	.0	.0	.0	.0	.5	.0	.0
6. Recpt 6	171.	1.2	.0	.0	.0	.0	.0	.6	.0	.0
7. Recpt 7	92.	2.1	.0	.0	.0	.0	.0	1.5	.0	.0
8. Recpt 8	84.	3.0	.0	.0	.0	.0	.0	2.5	.0	.0
9. Recpt 9	50.	2.2	.0	.2	.0	.0	.0	1.7	.0	.0
10. Recpt 10	2.	1.8	.0	.0	.0	.0	.0	.9	.0	.0

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: NASA#7 Moffett/Clark Alt1pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R
1. Recpt 1	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0
2. Recpt 2	.0	.0	.2	.0	.0	.0	.2	.3	.0	.0
3. Recpt 3	.0	.0	.2	.0	.0	.0	.0	.2	.0	.0
4. Recpt 4	.0	.0	.1	.1	.0	.0	.1	.4	.0	.0
5. Recpt 5	.0	.0	.0	.1	.0	.0	.4	.0	.0	.0
6. Recpt 6	.0	.0	.1	.0	.0	.0	.0	.4	.0	.0
7. Recpt 7	.0	.0	.1	.0	.0	.0	.0	.4	.0	.0
8. Recpt 8	.0	.0	.0	.0	.0	.0	.0	.3	.0	.0
9. Recpt 9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10. Recpt 10	.0	.0	.1	.0	.0	.0	.1	.4	.0	.0

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: NASA#7 Moffett/Clark Alt2pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	6 (F)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	10. DEGREES	TEMP=	7.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. MCEBC	*	250	405	345	489	* AG	825	5.7	.0	13.3
B. MCEBA	*	345	489	465	543	* AG	825	18.3	.0	13.3
C. MCEBD	*	465	543	608	600	* AG	479	7.1	.0	13.3
D. MCEBC	*	608	600	708	636	* AG	479	5.7	.0	13.3
E. MCWBC	*	703	647	606	606	* AG	2062	5.7	.0	13.3
F. MCWBA	*	606	606	464	553	* AG	2062	49.3	.0	13.3
G. MCWBD	*	464	553	342	499	* AG	2851	26.6	.0	13.3
H. MCWBC	*	342	499	241	414	* AG	2851	5.7	.0	13.3
I. MENBC	*	425	331	425	400	* AG	64	5.7	.0	13.3
J. MENBA	*	425	400	471	550	* AG	64	15.1	.0	13.3
K. MENBD	*	471	550	488	630	* AG	654	8.4	.0	13.3
L. MENBD	*	488	630	454	687	* AG	654	8.4	.0	13.3
M. MENBC	*	454	687	447	762	* AG	654	5.7	.0	13.3
N. MESBC	*	440	760	446	693	* AG	1067	5.7	.0	13.3
O. MESBA	*	446	693	482	628	* AG	1067	20.4	.0	13.3
P. MESBA	*	482	628	460	548	* AG	1067	20.4	.0	13.3
Q. MESBD	*	460	548	420	401	* AG	34	7.1	.0	13.3
R. MESBC	*	420	401	417	333	* AG	34	5.7	.0	13.3

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: NASA#7 Moffett/Clark Alt2pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (M) X	Y	Z
1. Recpt 1	*	464	483	1.8
2. Recpt 2	*	483	537	1.8
3. Recpt 3	*	488	576	1.8
4. Recpt 4	*	489	656	1.8
5. Recpt 5	*	439	678	1.8
6. Recpt 6	*	467	624	1.8

7. Recpt 7	462	581	1.8
8. Recpt 8	445	560	1.8
9. Recpt 9	442	521	1.8
10. Recpt 10	469	522	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. Recpt 1	3.	1.9	.0	.0	.0	.0	.0	.7	.3	.0
2. Recpt 2	352.	3.5	.0	.0	.1	.0	.0	2.1	.0	.0
3. Recpt 3	230.	5.0	.0	.5	.0	.0	.0	1.6	2.1	.0
4. Recpt 4	195.	2.6	.0	.1	.0	.0	.0	.4	.4	.0
5. Recpt 5	126.	2.0	.0	.0	.0	.0	.0	.8	.0	.0
6. Recpt 6	171.	2.1	.0	.0	.0	.0	.0	1.0	.0	.0
7. Recpt 7	93.	3.6	.0	.0	.0	.0	.0	2.5	.0	.0
8. Recpt 8	85.	5.1	.0	.0	.1	.0	.0	4.3	.0	.0
9. Recpt 9	30.	3.8	.0	.6	.0	.0	.0	.8	1.5	.0
10. Recpt 10	360.	3.2	.0	.0	.0	.0	.0	1.5	.2	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: NASA#7 Moffett/Clark Alt2pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R
1. Recpt 1	.0	.0	.0	.0	.0	.0	.2	.4	.0	.0
2. Recpt 2	.0	.0	.2	.0	.0	.0	.3	.6	.0	.0
3. Recpt 3	.0	.0	.2	.0	.0	.0	.0	.5	.0	.0
4. Recpt 4	.0	.0	.2	.2	.0	.0	.3	.9	.0	.0
5. Recpt 5	.0	.0	.0	.2	.0	.0	.9	.0	.0	.0
6. Recpt 6	.0	.0	.2	.0	.0	.0	.0	.9	.0	.0
7. Recpt 7	.0	.0	.2	.0	.0	.0	.0	.8	.0	.0
8. Recpt 8	.0	.0	.1	.0	.0	.0	.0	.5	.0	.0
9. Recpt 9	.0	.0	.2	.0	.0	.0	.0	.7	.0	.0
10. Recpt 10	.0	.0	.2	.0	.0	.0	.3	.8	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: NASA#7 Moffett/Clark Alt3pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	6 (F)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	10. DEGREES	TEMP=	7.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. MCEBC	*	250	405	345	489	* AG	792	5.7	.0	13.3
B. MCEBA	*	345	489	465	543	* AG	792	16.6	.0	13.3
C. MCEBD	*	465	543	608	600	* AG	569	7.1	.0	13.3
D. MCEBC	*	608	600	708	636	* AG	569	5.7	.0	13.3
E. MCWBC	*	703	647	606	606	* AG	2502	5.7	.0	13.3
F. MCWBA	*	606	606	464	553	* AG	2502	49.3	.0	13.3
G. MCWBD	*	464	553	342	499	* AG	2833	31.4	.0	13.3
H. MCWBC	*	342	499	241	414	* AG	2833	5.7	.0	13.3
I. MENBC	*	425	331	425	400	* AG	64	5.7	.0	13.3
J. MENBA	*	425	400	471	550	* AG	64	15.1	.0	13.3
K. MENBD	*	471	550	488	630	* AG	531	7.7	.0	13.3
L. MENBD	*	488	630	454	687	* AG	531	7.7	.0	13.3
M. MENBC	*	454	687	447	762	* AG	531	5.7	.0	13.3
N. MESBC	*	440	760	446	693	* AG	609	5.7	.0	13.3
O. MESBA	*	446	693	482	628	* AG	609	16.6	.0	13.3
P. MESBA	*	482	628	460	548	* AG	609	16.6	.0	13.3
Q. MESBD	*	460	548	420	401	* AG	34	7.7	.0	13.3
R. MESBC	*	420	401	417	333	* AG	34	5.7	.0	13.3

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: NASA#7 Moffett/Clark Alt3pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (M) X	Y	Z
1. Recpt 1	*	464	483	1.8
2. Recpt 2	*	483	537	1.8
3. Recpt 3	*	488	576	1.8
4. Recpt 4	*	489	656	1.8
5. Recpt 5	*	439	678	1.8
6. Recpt 6	*	467	624	1.8

7. Recpt 7	* 462	581	1.8
8. Recpt 8	* 445	560	1.8
9. Recpt 9	* 442	521	1.8
10. Recpt 10	* 469	522	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. Recpt 1	4.	1.8	.0	.0	.0	.0	.0	.9	.3	.0
2. Recpt 2	48.	3.7	.0	.0	.2	.0	.0	3.5	.0	.0
3. Recpt 3	230.	5.3	.0	.4	.0	.0	.0	1.9	2.5	.0
4. Recpt 4	195.	2.0	.0	.0	.0	.0	.0	.5	.5	.0
5. Recpt 5	126.	1.6	.0	.0	.0	.0	.0	1.0	.0	.0
6. Recpt 6	114.	1.9	.0	.0	.0	.0	.0	1.5	.0	.0
7. Recpt 7	93.	3.6	.0	.0	.0	.0	.0	3.0	.0	.0
8. Recpt 8	85.	5.5	.0	.0	.1	.0	.0	5.0	.0	.0
9. Recpt 9	50.	4.1	.0	.3	.1	.0	.0	3.4	.1	.0
10. Recpt 10	45.	2.9	.0	.0	.1	.0	.0	2.7	.0	.0

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CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: NASA#7 Moffett/Clark Alt3pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R
1. Recpt 1	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0
2. Recpt 2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. Recpt 3	.0	.0	.2	.0	.0	.0	.0	.2	.0	.0
4. Recpt 4	.0	.0	.1	.1	.0	.0	.2	.4	.0	.0
5. Recpt 5	.0	.0	.0	.1	.0	.0	.4	.0	.0	.0
6. Recpt 6	.0	.0	.0	.0	.0	.0	.0	.3	.0	.0
7. Recpt 7	.0	.0	.1	.0	.0	.0	.0	.4	.0	.0
8. Recpt 8	.0	.0	.0	.0	.0	.0	.0	.3	.0	.0
9. Recpt 9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10. Recpt 10	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: NASA#7 Moffett/Clark Alt4pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	6 (F)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	10. DEGREES	TEMP=	7.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. MCEBC	*	250	405	345	489	* AG	938	5.7	.0	13.3
B. MCEBA	*	345	489	465	543	* AG	938	18.3	.0	13.3
C. MCEBD	*	465	543	608	600	* AG	433	7.1	.0	13.3
D. MCEBC	*	608	600	708	636	* AG	433	5.7	.0	13.3
E. MCWBC	*	703	647	606	606	* AG	1908	5.7	.0	13.3
F. MCWBA	*	606	606	464	553	* AG	1908	49.3	.0	13.3
G. MCWBD	*	464	553	342	499	* AG	3347	31.4	.0	13.3
H. MCWBC	*	342	499	241	414	* AG	3347	5.7	.0	13.3
I. MENBC	*	425	331	425	400	* AG	64	5.7	.0	13.3
J. MENBA	*	425	400	471	550	* AG	64	15.1	.0	13.3
K. MENBD	*	471	550	488	630	* AG	813	12.0	.0	13.3
L. MENBD	*	488	630	454	687	* AG	813	12.0	.0	13.3
M. MENBC	*	454	687	447	762	* AG	813	5.7	.0	13.3
N. MESBC	*	440	760	446	693	* AG	1717	5.7	.0	13.3
O. MESBA	*	446	693	482	628	* AG	1717	26.6	.0	13.3
P. MESBA	*	482	628	460	548	* AG	1717	26.6	.0	13.3
Q. MESBD	*	460	548	420	401	* AG	34	7.1	.0	13.3
R. MESBC	*	420	401	417	333	* AG	34	5.7	.0	13.3

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: NASA#7 Moffett/Clark Alt4pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (M) X	Y	Z
1. Recpt 1	*	464	483	1.8
2. Recpt 2	*	483	537	1.8
3. Recpt 3	*	488	576	1.8
4. Recpt 4	*	489	656	1.8
5. Recpt 5	*	439	678	1.8
6. Recpt 6	*	467	624	1.8

7. Recpt 7	462	581	1.8
8. Recpt 8	445	560	1.8
9. Recpt 9	442	521	1.8
10. Recpt 10	469	522	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. Recpt 1	2.	2.7	.0	.1	.0	.0	.0	.6	.4	.0
2. Recpt 2	352.	4.4	.0	.0	.0	.0	.0	2.0	.0	.0
3. Recpt 3	232.	6.5	.0	.6	.0	.0	.0	1.2	3.1	.0
4. Recpt 4	196.	4.2	.0	.1	.0	.0	.0	.4	.6	.0
5. Recpt 5	127.	3.0	.0	.0	.0	.0	.0	.8	.0	.0
6. Recpt 6	171.	3.1	.0	.0	.0	.0	.0	.9	.0	.0
7. Recpt 7	177.	4.9	.0	.2	.0	.0	.0	.8	1.0	.0
8. Recpt 8	85.	5.5	.0	.0	.1	.0	.0	4.0	.0	.0
9. Recpt 9	25.	5.3	.0	.7	.0	.0	.0	.3	2.3	.0
10. Recpt 10	360.	4.3	.0	.0	.0	.0	.0	1.4	.2	.0

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: NASA#7 Moffett/Clark Alt4pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R
1. Recpt 1	.0	.0	.1	.0	.0	.0	.4	.9	.0	.0
2. Recpt 2	.0	.0	.4	.1	.0	.0	.6	1.1	.0	.0
3. Recpt 3	.0	.0	.4	.0	.0	.0	.0	1.1	.0	.0
4. Recpt 4	.0	.0	.3	.3	.0	.0	.7	1.8	.0	.0
5. Recpt 5	.0	.0	.0	.3	.0	.0	1.9	.0	.0	.0
6. Recpt 6	.0	.0	.3	.0	.0	.0	.0	1.8	.0	.0
7. Recpt 7	.0	.0	.0	.0	.0	.0	.0	2.8	.0	.0
8. Recpt 8	.0	.0	.2	.0	.0	.0	.0	1.1	.0	.0
9. Recpt 9	.0	.0	.2	.0	.0	.0	.1	1.5	.0	.0
10. Recpt 10	.0	.0	.3	.1	.0	.0	.5	1.6	.0	.0

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: NASA#7 Moffett/Clark Alt5pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	6 (F)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	10. DEGREES	TEMP=	7.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	*	LINK COORDINATES (M) X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. MCEBC	*	250	405	345	489	* AG	750	5.7	.0	13.3
B. MCEBA	*	345	489	465	543	* AG	750	16.6	.0	13.3
C. MCEBD	*	465	543	608	600	* AG	397	7.1	.0	13.3
D. MCEBC	*	608	600	708	636	* AG	397	5.7	.0	13.3
E. MCWBC	*	703	647	606	606	* AG	2004	5.7	.0	13.3
F. MCWBA	*	606	606	464	553	* AG	2004	49.3	.0	13.3
G. MCWBD	*	464	553	342	499	* AG	2399	31.4	.0	13.3
H. MCWBC	*	342	499	241	414	* AG	2399	5.7	.0	13.3
I. MENBC	*	425	331	425	400	* AG	64	5.7	.0	13.3
J. MENBA	*	425	400	471	550	* AG	64	15.1	.0	13.3
K. MENBD	*	471	550	488	630	* AG	661	8.4	.0	13.3
L. MENBD	*	488	630	454	687	* AG	661	8.4	.0	13.3
M. MENBC	*	454	687	447	762	* AG	661	5.7	.0	13.3
N. MESBC	*	440	760	446	693	* AG	673	5.7	.0	13.3
O. MESBA	*	446	693	482	628	* AG	673	16.6	.0	13.3
P. MESBA	*	482	628	460	548	* AG	673	16.6	.0	13.3
Q. MESBD	*	460	548	420	401	* AG	34	7.1	.0	13.3
R. MESBC	*	420	401	417	333	* AG	34	5.7	.0	13.3

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CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: NASA#7 Moffett/Clark Alt5pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (M) X	Y	Z
1. Recpt 1	*	464	483	1.8
2. Recpt 2	*	483	537	1.8
3. Recpt 3	*	488	576	1.8
4. Recpt 4	*	489	656	1.8
5. Recpt 5	*	439	678	1.8
6. Recpt 6	*	467	624	1.8

7. Recpt 7	* 462	581	1.8
8. Recpt 8	* 445	560	1.8
9. Recpt 9	* 442	521	1.8
10. Recpt 10	* 469	522	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. Recpt 1	3.	1.6	.0	.0	.0	.0	.0	.7	.3	.0
2. Recpt 2	48.	3.1	.0	.0	.1	.0	.0	3.0	.0	.0
3. Recpt 3	230.	4.7	.0	.4	.0	.0	.0	1.6	2.2	.0
4. Recpt 4	195.	2.0	.0	.0	.0	.0	.0	.4	.4	.0
5. Recpt 5	126.	1.5	.0	.0	.0	.0	.0	.8	.0	.0
6. Recpt 6	114.	1.7	.0	.0	.0	.0	.0	1.3	.0	.0
7. Recpt 7	93.	3.1	.0	.0	.0	.0	.0	2.5	.0	.0
8. Recpt 8	85.	4.7	.0	.0	.0	.0	.0	4.2	.0	.0
9. Recpt 9	47.	3.5	.0	.4	.0	.0	.0	2.6	.2	.0
10. Recpt 10	3.	2.6	.0	.0	.0	.0	.0	1.6	.1	.0

□□

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: NASA#7 Moffett/Clark Alt5pm
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R
1. Recpt 1	.0	.0	.0	.0	.0	.0	.1	.2	.0	.0
2. Recpt 2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. Recpt 3	.0	.0	.2	.0	.0	.0	.0	.3	.0	.0
4. Recpt 4	.0	.0	.2	.2	.0	.0	.2	.5	.0	.0
5. Recpt 5	.0	.0	.0	.2	.0	.0	.5	.0	.0	.0
6. Recpt 6	.0	.0	.1	.0	.0	.0	.0	.3	.0	.0
7. Recpt 7	.0	.0	.2	.0	.0	.0	.0	.4	.0	.0
8. Recpt 8	.0	.0	.1	.0	.0	.0	.0	.3	.0	.0
9. Recpt 9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
10. Recpt 10	.0	.0	.2	.0	.0	.0	.1	.4	.0	.0

□□

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 **NASA PM Expressway/AM Fringe Area**

YEAR: 2013	DEWPOINT: 10	% COLD STARTS	15.0	% LDA	62.0	% LDT	27.0	% MDT	7.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	25.0	% UBD	0.5	% HDG	0.0	% HDD	3.0
SEASON: WINTER		% HOT STAB	60.0			% MCY	0.5		

TABLE 1: ESTIMATED TRAVEL FRACTIONS

	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MED DUTY TRUCKS		URBAN BUS	HEAVY DUTY TRUCKS			MCY
	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	ALL
% VMT	0.00	99.97	0.03	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00
% TRIP	0.00	99.97	0.03	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00
% VEH	0.01	99.93	0.06	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00

1ENV028F1.1 CALTRANS DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH RUN DATES: ENV028F1.1 10/16/2001 EMFAC7F1.1 10/16/2001

EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 NASA PM Expressway/AM Fringe Area

YEAR: 2013 DEWPOINT: 10 % COLD STARTS 15.0 % LDA 62.0 % LDT 27.0 % MDT 7.0
INSPECTION & MAINTENANCE: YES % HOT STARTS 25.0 % UBD 0.5 % HDG 0.0 % HDD 3.0
SEASON: WINTER % HOT STAB 60.0 % MCY 0.5

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH	40	45	MPH	40	45
IDLE*	1.43	1.34	22	4.88	4.63
3	28.64	26.87	23	4.68	4.44
4	22.84	21.49	24	4.50	4.26
5	19.06	17.97	25	4.32	4.10
6	16.36	15.45	26	4.17	3.95
7	14.33	13.54	27	4.02	3.82
8	12.74	12.05	28	3.89	3.69
9	11.45	10.84	29	3.77	3.57
10	10.39	9.84	30	3.65	3.46
11	9.51	9.00	31	3.54	3.36
12	8.76	8.29	32	3.44	3.27
13	8.11	7.69	33	3.35	3.18
14	7.56	7.16	34	3.26	3.10
15	7.07	6.70	35	3.18	3.02
16	6.64	6.29	36	3.11	2.95
17	6.26	5.94	37	3.04	2.89
18	5.93	5.62	38	2.98	2.83
19	5.62	5.33	39	2.92	2.77
20	5.35	5.07	40	2.86	2.72
21	5.11	4.84			

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

1ENV028F1.1

CALTRANS DIVISION OF
NEW TECHNOLOGY, MATERIALS AND RESEARCH
EMFAC7F1.1 RATES AS OF 1/25/94

RUN DATES: ENV028F1.1 10/17/2001
EMFAC7F1.1 10/17/2001

TIME RATE ADJUSTMENT BAGS 1 & 3 NASA Screening Emission Factors

YEAR: 2013 DEWPOINT: 10 % COLD STARTS 25.0 % LDA 62.0 % LDT 27.0 % MDT 7.0
INSPECTION & MAINTENANCE: YES % HOT STARTS 25.0 % UBD 1.0 % HDG 0.0 % HDD 2.0
SEASON: WINTER % HOT STAB 50.0 % MCY 1.0

TABLE 1: ESTIMATED TRAVEL FRACTIONS

	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MED DUTY TRUCKS		URBAN BUS	HEAVY DUTY TRUCKS			MCY
	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	ALL
% VMT	0.00	99.97	0.03	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00
% TRIP	0.00	99.97	0.03	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00
% VEH	0.01	99.93	0.06	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00

1ENV028F1.1

CALTRANS DIVISION OF
NEW TECHNOLOGY, MATERIALS AND RESEARCH
EMFAC7F1.1 RATES AS OF 1/25/94

RUN DATES: ENV028F1.1 10/17/2001
EMFAC7F1.1 10/17/2001

TIME RATE ADJUSTMENT BAGS 1 & 3 NASA Screening Emission Factors

YEAR: 2013 DEWPOINT: 10 % COLD STARTS 25.0 % LDA 62.0 % LDT 27.0 % MDT 7.0
INSPECTION & MAINTENANCE: YES % HOT STARTS 25.0 % UBD 1.0 % HDG 0.0 % HDD 2.0
SEASON: WINTER % HOT STAB 50.0 % MCY 1.0

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE IN GRAMS PER MILE

SPEED MPH	TEMPERATURE IN DEGREES FAHRENHEIT 40	45
IDLE*	1.97	1.83
3	39.38	36.59
4	30.91	28.80
5	25.52	23.82
6	21.75	20.33
7	18.94	17.72
8	16.77	15.70
9	15.03	14.08
10	13.62	12.76
11	12.44	11.66
12	11.44	10.73
13	10.59	9.93
14	9.86	9.24
15	9.22	8.64
16	8.66	8.12
17	8.16	7.65
18	7.72	7.24
19	7.32	6.87
20	6.96	6.53

SPEED MPH	TEMPERATURE IN DEGREES FAHRENHEIT 40	45
21	6.64	6.23
22	6.35	5.96
23	6.08	5.71
24	5.84	5.48
25	5.62	5.27
26	5.43	5.09
27	5.22	4.90
28	5.04	4.73
29	4.88	4.58
30	4.73	4.44
31	4.58	4.30
32	4.45	4.18
33	4.33	4.07
34	4.21	3.96
35	4.11	3.86
36	4.01	3.76
37	3.91	3.68
38	3.83	3.60
39	3.75	3.52
40	3.67	3.45

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

1ENV028F1.1 CALTRANS DIVISION OF RUN DATES: ENV028F1.1 10/16/2001
NEW TECHNOLOGY, MATERIALS AND RESEARCH EMFAC7F1.1 10/16/2001
EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 NASA PM Fringe Area

YEAR: 2013	DEWPOINT: 10	% COLD STARTS	40.0	% LDA	62.0	% LDT	27.0	% MDT	7.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	25.0	% UBD	0.5	% HDG	0.0	% HDD	3.0
SEASON: WINTER		% HOT STAB	35.0			% MCY	0.5		

TABLE 1: ESTIMATED TRAVEL FRACTIONS

	LIGHT DUTY AUTOS			LIGHT DUTY TRUCKS			MED DUTY TRUCKS		URBAN BUS	HEAVY DUTY TRUCKS			MCY
	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	NCAT	CAT	DIESEL	ALL
% VMT	0.00	99.97	0.03	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00
% TRIP	0.00	99.97	0.03	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00
% VEH	0.01	99.93	0.06	0.00	100.00	0.00	0.00	100.00	100.00	11.00	89.00	100.00	100.00

1ENV028F1.1 CALTRANS DIVISION OF RUN DATES: ENV028F1.1 10/16/2001
NEW TECHNOLOGY, MATERIALS AND RESEARCH EMFAC7F1.1 10/16/2001
EMFAC7F1.1 RATES AS OF 1/25/94

TIME RATE ADJUSTMENT BAGS 1 & 3 NASA PM Fringe Area

YEAR: 2013	DEWPOINT: 10	% COLD STARTS	40.0	% LDA	62.0	% LDT	27.0	% MDT	7.0
INSPECTION & MAINTENANCE: YES		% HOT STARTS	25.0	% UBD	0.5	% HDG	0.0	% HDD	3.0
SEASON: WINTER		% HOT STAB	35.0			% MCY	0.5		

TABLE 2: COMPOSITE EMISSION FACTORS

POLLUTANT NAME: CARBON MONOXIDE IN GRAMS PER MILE

SPEED TEMPERATURE IN DEGREES FAHRENHEIT

MPH	40	45
IDLE*	2.67	2.46
3	53.45	49.25
4	41.44	38.27
5	33.94	31.40
6	28.77	26.64
7	24.96	23.14
8	22.04	20.44
9	19.72	18.30
10	17.83	16.55
11	16.27	15.11
12	14.96	13.89
13	13.84	12.85
14	12.87	11.96
15	12.03	11.18
16	11.29	10.49
17	10.64	9.89
18	10.06	9.35
19	9.54	8.86
20	9.07	8.43
21	8.65	8.04
22	8.27	7.68
23	7.92	7.36
24	7.60	7.06
25	7.30	6.79
26	7.08	6.57
27	6.78	6.30
28	6.55	6.09
29	6.33	5.89
30	6.13	5.70
31	5.94	5.53
32	5.77	5.37
33	5.61	5.21
34	5.45	5.07
35	5.31	4.94
36	5.18	4.82
37	5.05	4.70
38	4.93	4.59
39	4.83	4.49
40	4.72	4.40

*IDLE EMISSIONS IN GRAMS/MIN, DERIVED FROM 3 MPH RATES

Table B.13 Average Speeds in mph for Approach Segments [Garza, 1995a]

Cruise Speed	% Red Time	Traffic Volume (vehicles per hour per lane)								
		200	300	400	500	600	700	800	900	1000
15	30	10.7	10.4	10.2	9.9	9.4	8.7	7.9	6.9	5.4
15	40	9.4	9.0	8.8	8.3	7.8	7.0	5.8	4.1	2.5*
15	50	8.1	7.8	7.4	6.9	6.1	4.6	2.8*	1.6*	0.9
15	60	7.0	6.6	6.1	5.0	3.1	1.6*	0.9	0.5	0.3
15	70	5.9	5.3	3.6	1.6*	0.7*	0.4	0.2	0.1	0.1
15	80	4.4	1.6*	0.5*	0.2	0.1	0.1	0.0	0.0	0.0
15	90	0.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	30	13.0	12.6	12.3	11.8	11.2	10.2	9.1	7.8	6.0
20	40	11.1	10.7	10.3	9.7	9.0	7.9	6.4	4.4	2.6*
20	50	9.4	9.0	8.5	7.8	6.8	5.0	2.9*	1.6*	0.9
20	60	7.9	7.4	6.7	5.5	3.3	1.6*	0.9	0.5	0.3
20	70	6.6	5.8	3.8	1.6*	0.7*	0.4	0.2	0.1	0.1
20	80	4.7	1.6*	0.5*	0.2	0.1	0.1	0.0	0.0	0.0
20	90	0.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	30	15.0	14.5	14.0	13.4	12.6	11.4	10.0	8.4	6.4
25	40	12.5	12.0	11.4	10.8	9.9	8.6	6.9	4.6	2.6*
25	50	10.4	9.8	9.2	8.4	7.3	5.2	3.0	1.6*	1.0
25	60	8.6	8.0	7.2	5.8	3.4	1.7*	0.9*	0.5	0.3
25	70	7.0	6.1	4.0	1.7*	0.7*	0.4	0.2	0.1	0.1
25	80	5.0	1.7*	0.5*	0.2	0.1	0.1	0.0	0.0	0.0
25	90	0.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	30	16.7	16.1	15.5	14.7	13.7	12.4	10.7	8.9	6.7
30	40	13.7	13.1	12.4	11.6	10.6	9.2	7.2	4.8	2.7*
30	50	11.1	10.5	9.8	9.0	7.6	5.4	3.0	1.6*	1.0
30	60	9.1	8.5	7.6	6.1	3.5	1.7*	0.9*	0.5	0.3
30	70	7.4	6.4	4.1	1.7*	0.7*	0.4	0.2	0.1	0.1
30	80	5.1	1.7*	0.5*	0.2	0.1	0.1	0.0	0.0	0.0
30	90	0.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	30	18.1	17.4	16.7	15.8	14.7	13.1	11.2	9.3	6.9
35	40	14.6	13.9	13.1	12.3	11.1	9.6	7.4	4.9	2.7*
35	50	11.8	11.0	10.3	9.3	7.9	5.5	3.1	1.6*	1.0
35	60	9.5	8.8	7.9	6.2	3.5	1.7*	0.9*	0.5	0.3
35	70	7.7	6.6	4.2	1.7*	0.7*	0.4	0.2	0.1	0.1
35	80	5.3	1.7*	0.5*	0.2	0.1	0.1	0.0	0.0	0.0
35	90	0.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	30	19.4	18.6	17.8	16.8	15.5	13.7	11.7	9.6	7.1
40	40	15.4	14.6	13.8	12.8	11.6	9.9	7.7	4.9	2.7*
40	50	12.3	11.5	10.7	9.7	8.2	5.7	3.1	1.7*	1.0
40	60	9.8	9.1	8.1	6.4	3.6	1.7*	0.9*	0.5	0.3
40	70	7.9	6.8	4.2	1.7*	0.7*	0.4	0.2	0.1	0.1
40	80	5.4	1.7*	0.5*	0.2	0.1	0.1	0.0	0.0	0.0
40	90	0.2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

** Values below 3 mph for interpolation purposes only*

Table B.14 Average Speeds in mph for Departure Segments [Garza, 1995a].

Cruise Speed	% Red Time	Traffic Volume (vehicles per hour per lane)								
		200	300	400	500	600	700	800	900	1000
15	30	14.2	14.1	14.0	14.0	13.9	13.6	13.4	13.0	12.1
15	40	13.9	13.7	13.7	13.5	13.2	13.0	12.4	11.2	9.1
15	50	13.4	13.3	13.2	13.0	12.6	11.7	9.6	7.4	5.2
15	60	13.1	12.8	12.6	12.0	10.2	7.3	5.2	3.3	2.7*
15	70	12.4	11.9	10.7	7.2	3.9	3.2	1.6*	1.2*	0.9
15	80	11.3	7.0	3.8	2.2*	1.0*	0.3*	0.0	0.0	0.0
15	90	1.8*	0.1*	0.0*	0.0	0.0	0.0	0.0	0.0	0.0
20	30	18.6	18.5	18.4	18.2	18.1	17.8	17.3	16.6	15.2
20	40	18.1	17.9	17.7	17.5	17.2	16.5	15.6	13.8	10.9
20	50	17.4	17.3	17.0	16.6	15.9	14.4	11.3	8.3	5.2
20	60	16.6	16.4	15.7	14.8	12.1	8.1	5.2	3.3	2.7*
20	70	15.8	15.2	12.8	8.0	5.1	3.2	1.6*	1.2*	0.9
20	80	14.1	7.8	3.8	2.2*	1.0*	0.3*	0.0	0.0	0.0
20	90	1.8*	0.1*	0.0*	0.0	0.0	0.0	0.0	0.0	0.0
25	30	22.8	22.7	22.6	22.4	22.0	21.5	20.9	19.8	17.9
25	40	22.1	21.9	21.5	21.3	20.8	19.8	18.5	15.7	11.6
25	50	21.0	20.7	20.4	19.7	18.9	16.5	12.5	8.3	6.5
25	60	20.0	19.4	18.7	17.3	13.9	9.1	5.2	3.3	2.7*
25	70	18.6	17.6	14.9	9.0	5.1	3.2	1.6*	1.2*	0.9
25	80	16.2	8.7	3.8	2.2*	1.0*	0.3*	0.0	0.0	0.0
25	90	1.8*	0.1*	0.0*	0.0	0.0	0.0	0.0	0.0	0.0
30	30	27.0	26.9	26.7	26.3	25.8	25.3	24.2	22.8	20.6
30	40	25.9	25.6	25.2	24.8	24.1	23.0	21.0	17.8	13.2
30	50	24.4	24.0	23.6	23.0	21.7	18.8	14.0	9.3	6.5
30	60	23.0	22.5	21.5	19.9	15.3	9.1	5.2	3.3	2.7*
30	70	21.5	20.0	16.7	9.0	5.1	3.2	1.6*	1.2*	0.9
30	80	18.2	9.7	3.8	2.2*	1.0*	0.3*	0.0	0.0	0.0
30	90	1.8*	0.1*	0.0*	0.0	0.0	0.0	0.0	0.0	0.0
35	30	31.1	30.9	30.5	29.9	29.5	28.7	27.3	25.8	22.8
35	40	29.6	29.1	28.6	28.1	27.2	26.0	23.5	19.5	14.1
35	50	27.6	27.1	26.7	25.6	24.1	20.4	14.8	9.3	6.5
35	60	25.9	25.0	24.2	21.8	16.0	10.2	5.2	3.3*	2.7*
35	70	23.9	22.3	18.0	10.1	5.1	3.2	1.6*	1.2	0.9
35	80	20.4	9.7	3.8	2.2*	1.0*	0.3*	0.2	0.0	0.0
35	90	1.8*	0.1*	0.0*	0.0	0.0	0.0	0.0	0.0	0.0
40	30	35.1	34.7	34.3	33.6	33.0	31.9	30.3	28.4	24.7
40	40	33.0	32.5	32.0	31.2	30.3	28.5	25.7	20.8	14.1
40	50	30.6	30.2	29.4	28.2	26.6	22.1	15.7	10.5	6.5
40	60	28.5	27.7	26.4	23.4	16.8	10.2	6.6	3.3	2.7*
40	70	26.1	24.3	18.7	10.1	5.1	3.2	1.6*	1.2*	0.9
40	80	21.6	9.7	3.8	2.2*	1.0*	0.3*	0.2	0.0	0.0
40	90	1.8*	0.1*	0.0*	0.0	0.0	0.0	0.0	0.0	0.0

** Values below 3 mph for interpolation purposes only*

APPENDIX D 3

ANNUAL AIR POLLUTANT EMISSIONS

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 2 Construction
ROG

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.0155**		
2003	0.0148	--	--
2004	0.0141	0.0001	0.0064
2005	**0.0134**	**0.0001**	**0.0059**
2006	0.0126	0.0001	0.0054
2007	0.0118	0.0001	0.0049
2008	0.0110	0.0001	0.0044
2009	0.0102	0.0001	0.0039
2010	**0.0094**	**0.0001**	**0.0034**
2011	0.0089	0.0001	0.0032
2012	0.0084	0.0001	0.0030
2013	0.0078	0.0001	0.0027
2014	0.0073	0.0001	0.0025
2015	**0.0068**	**0.0001**	**0.0023**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
519.3	0	7.7
519.3	519	10.7
519.3	1039	13.1
519.3	1558	15.1
519.3	2077	16.5
519.3	2597	17.4
519.3	3116	17.8
519.3	3635	17.6
519.3	4154	18.2
519.3	4674	18.6
	5193	14.6
	5193	13.4
	5193	12.2

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 21,517 week day trips at 6.9 mi per trip for 5,193,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 2 Construction
NOx

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.2312**		
2003	0.2231	--	--
2004	0.2151	0.0018	0.0119
2005	**0.2070**	**0.0018**	**0.0114**
2006	0.1974	0.0018	0.0109
2007	0.1877	0.0018	0.0104
2008	0.1780	0.0018	0.0099
2009	0.1684	0.0018	0.0094
2010	**0.1587**	**0.0018**	**0.0089**
2011	0.1511	0.0018	0.0087
2012	0.1435	0.0018	0.0085
2013	0.1359	0.0018	0.0082
2014	0.1284	0.0018	0.0080
2015	**0.1208**	**0.0018**	**0.0078**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
519.3	0	115.9
519.3	519	118.8
519.3	1039	121.2
519.3	1558	122.3
519.3	2077	122.9
519.3	2597	122.9
519.3	3116	122.4
519.3	3635	121.4
519.3	4154	122.0
519.3	4674	122.5
	5193	52.1
	5193	51.0
	5193	49.8

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 21,517 week day trips at 6.9 mi per trip for 5,193,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 2 Construction
CO

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.0405**		
2003	0.0388	--	--
2004	0.0370	0.0008	0.1577
2005	**0.0353**	**0.0008**	**0.1469**
2006	0.0347	0.0008	0.1361
2007	0.0341	0.0008	0.1253
2008	0.0335	0.0008	0.1145
2009	0.0329	0.0008	0.1037
2010	**0.0323**	**0.0008**	**0.0929**
2011	0.0318	0.0008	0.0870
2012	0.0314	0.0008	0.0811
2013	0.0309	0.0008	0.0752
2014	0.0305	0.0008	0.0693
2015	**0.0300**	**0.0008**	**0.0634**

INPUT DATA

Incremental 1000s ft^2 Const	**1000s ft^2 Occupancy**	Annual Emissions (tons per year)
519.3	0	20.1
519.3	519	101.5
519.3	1039	171.7
519.3	1558	231.2
519.3	2077	279.6
519.3	2597	316.7
519.3	3116	342.6
519.3	3635	357.3
519.3	4154	381.1
519.3	4674	398.8
	5193	394.4
	5193	363.7
	5193	333.0

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 21,517 week day trips at 6.9 mi per trip for 5,193,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 3 Construction
ROG

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.0160**		
2003	0.0153	--	--
2004	0.0145	0.0001	0.0058
2005	**0.0138**	**0.0001**	**0.0053**
2006	0.0130	0.0001	0.0049
2007	0.0122	0.0001	0.0044
2008	0.0113	0.0001	0.0040
2009	0.0105	0.0001	0.0035
2010	**0.0097**	**0.0001**	**0.0031**
2011	0.0092	0.0001	0.0029
2012	0.0086	0.0001	0.0027
2013	0.0081	0.0001	0.0025
2014	0.0076	0.0001	0.0023
2015	**0.0070**	**0.0001**	**0.0020**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
434.3	0	6.6
434.3	434	8.8
434.3	869	10.7
434.3	1303	12.1
434.3	1737	13.1
434.3	2172	13.8
434.3	2606	14.0
434.3	3040	13.9
434.3	3474	14.3
434.3	3909	14.5
	4343	11.1
	4343	10.1
	4343	9.2

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 15,721 week day trips at 6.9 mi per trip for 4,343,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 3 Construction
NOx

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.2385**		
2003	0.2302	--	--
2004	0.2219	0.0018	0.0108
2005	**0.2136**	**0.0018**	**0.0103**
2006	0.2036	0.0018	0.0099
2007	0.1936	0.0018	0.0094
2008	0.1837	0.0018	0.0090
2009	0.1737	0.0018	0.0085
2010	**0.1637**	**0.0018**	**0.0081**
2011	0.1559	0.0018	0.0078
2012	0.1481	0.0018	0.0076
2013	0.1402	0.0018	0.0074
2014	0.1324	0.0018	0.0072
2015	**0.1246**	**0.0018**	**0.0070**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
434.3	0	100.0
434.3	434	101.8
434.3	869	103.3
434.3	1303	103.6
434.3	1737	103.6
434.3	2172	103.1
434.3	2606	102.3
434.3	3040	101.1
434.3	3474	101.2
434.3	3909	101.2
	4343	40.2
	4343	39.3
	4343	38.4

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 15,721 week day trips at 6.9 mi per trip for 4,343,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 3 Construction
CO

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.0405**		
2003	0.0388	--	--
2004	0.0370	0.0010	0.1590
2005	**0.0353**	**0.0010**	**0.1487**
2006	0.0347	0.0010	0.1385
2007	0.0341	0.0010	0.1282
2008	0.0335	0.0010	0.1180
2009	0.0329	0.0010	0.1077
2010	**0.0323**	**0.0010**	**0.0975**
2011	0.0318	0.0010	0.0918
2012	0.0314	0.0010	0.0861
2013	0.0309	0.0010	0.0804
2014	0.0305	0.0010	0.0747
2015	**0.0300**	**0.0010**	**0.0690**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
434.3	0	16.8
434.3	434	85.5
434.3	869	145.3
434.3	1303	196.7
434.3	1737	239.2
434.3	2172	272.8
434.3	2606	297.6
434.3	3040	313.4
434.3	3474	336.1
434.3	3909	354.0
	4343	353.4
	4343	328.6
	4343	303.9

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 15,721 week day trips at 6.9 mi per trip for 4,343,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 4 Construction
ROG

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.0157**		
2003	0.0150	--	--
2004	0.0143	0.0001	0.0064
2005	**0.0135**	**0.0001**	**0.0060**
2006	0.0127	0.0001	0.0055
2007	0.0119	0.0001	0.0050
2008	0.0111	0.0001	0.0045
2009	0.0103	0.0001	0.0040
2010	**0.0095**	**0.0001**	**0.0035**
2011	0.0090	0.0001	0.0032
2012	0.0085	0.0001	0.0030
2013	0.0079	0.0001	0.0028
2014	0.0074	0.0001	0.0025
2015	**0.0069**	**0.0001**	**0.0023**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
621.3	0	9.3
621.3	621	12.9
621.3	1243	15.9
621.3	1864	18.3
621.3	2485	20.0
621.3	3107	21.1
621.3	3728	21.6
621.3	4349	21.4
621.3	4970	22.2
621.3	5592	22.6
	6213	17.8
	6213	16.3
	6213	14.8

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 26,528 week day trips at 6.9 mi per trip for 6,213,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 4 Construction
NOx

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.2340**		
2003	0.2258	--	--
2004	0.2177	0.0018	0.0121
2005	**0.2095**	**0.0018**	**0.0116**
2006	0.1998	0.0018	0.0111
2007	0.1900	0.0018	0.0106
2008	0.1802	0.0018	0.0100
2009	0.1704	0.0018	0.0095
2010	**0.1607**	**0.0018**	**0.0090**
2011	0.1530	0.0018	0.0088
2012	0.1453	0.0018	0.0086
2013	0.1376	0.0018	0.0083
2014	0.1299	0.0018	0.0081
2015	**0.1222**	**0.0018**	**0.0079**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
621.3	0	140.3
621.3	621	143.9
621.3	1243	146.8
621.3	1864	148.1
621.3	2485	148.7
621.3	3107	148.7
621.3	3728	148.1
621.3	4349	146.9
621.3	4970	147.7
621.3	5592	148.2
	6213	63.0
	6213	61.6
	6213	60.2

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 26,528 week day trips at 6.9 mi per trip for 6,213,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 4 Construction
CO

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2002	**0.0410**		
2003	0.0392	--	--
2004	0.0375	0.0006	0.1596
2005	**0.0357**	**0.0006**	**0.1487**
2006	0.0351	0.0006	0.1378
2007	0.0345	0.0006	0.1269
2008	0.0339	0.0006	0.1159
2009	0.0333	0.0006	0.1050
2010	**0.0327**	**0.0006**	**0.0941**
2011	0.0322	0.0006	0.0881
2012	0.0317	0.0006	0.0821
2013	0.0313	0.0006	0.0761
2014	0.0308	0.0006	0.0701
2015	**0.0304**	**0.0006**	**0.0641**

INPUT DATA

Incremental 1000s ft^2 Const	**1000s ft^2 Occupancy**	Annual Emissions (tons per year)
621.3	0	24.4
621.3	621	122.9
621.3	1243	207.8
621.3	1864	279.8
621.3	2485	338.3
621.3	3107	383.2
621.3	3728	414.5
621.3	4349	432.2
621.3	4970	461.0
621.3	5592	482.4
	6213	476.8
	6213	439.6
	6213	402.4

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 26,528 week day trips at 6.9 mi per trip for 6,213,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 5 Construction
ROG

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
	0.0138		
2003	0.0132	--	--
2004	0.0126	0.0001	0.0063
2005	**0.0120**	**0.0001**	**0.0058**
2006	0.0112	0.0001	0.0054
2007	0.0105	0.0001	0.0049
2008	0.0098	0.0001	0.0044
2009	0.0091	0.0001	0.0039
2010	**0.0084**	**0.0001**	**0.0034**
2011	0.0079	0.0001	0.0032
2012	0.0075	0.0001	0.0029
2013	0.0070	0.0001	0.0027
2014	0.0065	0.0001	0.0025
2015	**0.0061**	**0.0001**	**0.0023**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
413.3	0	5.5
413.3	413	7.9
413.3	827	9.9
413.3	1240	11.4
413.3	1653	12.6
413.3	2067	13.4
413.3	2480	13.7
413.3	2893	13.7
413.3	3306	14.2
413.3	3720	14.5
	4133	11.7
	4133	10.8
	4133	9.8

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 15,167 daily trips at 6.9 mi per trip for 4,133,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 5 Construction
NOx

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
2003	**0.1972**	--	--
2004	0.1916	0.0018	0.0119
2005	0.1860	**0.0018**	**0.0114**
2006	0.1773	0.0018	0.0109
2007	0.1686	0.0018	0.0104
2008	0.1600	0.0018	0.0099
2009	0.1513	0.0018	0.0094
2010	0.1426	**0.0018**	**0.0089**
2011	0.1358	0.0018	0.0086
2012	0.1290	0.0018	0.0084
2013	0.1221	0.0018	0.0082
2014	0.1153	0.0018	0.0080
2015	0.1085	**0.0018**	**0.0077**

INPUT DATA

Incremental 1000s ft^2 Const	**1000s ft^2 Occupancy**	Annual Emissions (tons per year)
413.3	0	81.5
413.3	413	84.8
413.3	827	87.8
413.3	1240	89.0
413.3	1653	89.8
413.3	2067	90.2
413.3	2480	90.2
413.3	2893	89.8
413.3	3306	90.6
413.3	3720	91.3
	4133	41.3
	4133	40.4
	4133	39.4

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 15,167 daily trips at 6.9 mi per trip for 4,133,000 sq. ft.

NASA AMES DEVELOPMENT PLAN
Total Annual Air Pollutant Emissions
Emissions by 1000 Square Feet of Construction
based on Alt 5 Construction
CO

Emission Factor (tons per 1000 ft^2)

Year	Construction	Area	Mobile
	0.0362		
2003	0.0346	--	--
2004	0.0331	0.0010	0.1566
2005	**0.0315**	**0.0010**	**0.1459**
2006	0.0310	0.0010	0.1352
2007	0.0304	0.0010	0.1245
2008	0.0299	0.0010	0.1138
2009	0.0294	0.0010	0.1030
2010	**0.0288**	**0.0010**	**0.0923**
2011	0.0284	0.0010	0.0864
2012	0.0280	0.0010	0.0806
2013	0.0276	0.0010	0.0747
2014	0.0272	0.0010	0.0688
2015	**0.0268**	**0.0010**	**0.0629**

INPUT DATA

Incremental 1000s ft^2 Const	1000s ft^2 Occupancy	Annual Emissions (tons per year)
413.3	0	14.3
413.3	413	78.8
413.3	827	134.4
413.3	1240	181.6
413.3	1653	220.0
413.3	2067	249.4
413.3	2480	270.0
413.3	2893	281.8
413.3	3306	300.7
413.3	3720	314.8
	4133	312.7
	4133	288.4
	4133	264.1

Note: Emissions factors are a composite factor for square footage. These factors change with year and mix of land uses. Factors were developed for 2000, 2005, 2010, and 2015 - then interpolated for other years.

Mobile source emissions calculated based on 15,167 daily trips at 6.9 mi per trip for 4,133,000 sq. ft.

NASA AMES DEVELOPMENT PLAN

Development of Construction Emission Factors
Alternative 2

Development Data and Emission Factors for Construction of Land Use Types Associated with the NASA/AMES Research Park Plan - Conformity Analysis.

		Emission Factors				
Land Use Type		*ROG*	*CO*	*NOx*	*PM10*	*Units*
Dormitory/Housing		22.0	70.2	322.9	22.93	lbs/1000 ft^2
Hotel		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Museum/Exhibit Space		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Office Park		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Research & Development		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Retail		31.8	101.6	467.0	33.2	lbs/1000 ft^2
University		47.0	150.2	690.5	49.0	lbs/1000 ft^2

Yearly Adjustment Factors

Year	ROG	CO	NOx	PM
1990	1.08	1.08	1.08	1.08
1995	0.90	0.83	0.89	0.84
2000	0.72	0.59	0.72	0.60
2005	0.57	0.47	0.60	0.50
2010	0.40	0.43	0.46	0.39
2015	0.29	0.40	0.35	0.29
2020	0.24	0.39	0.30	0.24

Total Emissions in Tons Throughout Construction Period

Use	**Size**	**Units**	***ROG***	***NOx***	***CO***	***PM10***
NRP Area:						-
Educational Uses	840	ksf	20	290	63	21
Computer Museum	70	ksf	1	21	5	2
CASC	390	ksf	11	159	35	11
Coference Center & Gym	200	ksf	4	61	13	4
Housing (188 800f^2 units)	150	ksf	2	24	5	2
Housing (300 1200f^2 units)	360	ksf	4	58	13	4
Office High Density R&D	502	ksf	14	204	44	15
Retail and Support	50	ksf	1	12	3	1
Ames Campus Area						
No Uses Under this Alt.	0	ksf	-	-	-	-
Eastside Airfield Area						
Office High Density R&D	360	ksf	10	147	32	10
Low Density R&D	891	ksf	25	363	79	26
Disaster Training	80	ksf	2	28	6	2
Bay View Area						
Educational/Child Care Uses	500	ksf	12	173	38	12
Housing (250 1200f^2 units)	300	ksf	3	48	11	3
Office High Density R&D	500	ksf	14	204	44	14
			-	-	-	-
Total Uncontrolled	5193		122	1792	390	127
Adjust for New 1990 Factors			132	1935	421	137
Adjust for future years	**2002**		**80**	**1200**	**210**	**70**
	2005		**69**	**1075**	**183**	**64**
	2010		**49**	**824**	**168**	**50**
	2015		**35**	**627**	**156**	**37**
	2020		**29**	**538**	**152**	**31**

Annual Emission Factor (tons per 1000 square foot) Assuming 10-year Build Out

ROG	NOx	CO	PM
0.0155	0.2312	0.0405	0.0135
0.0134	0.2070	0.0353	0.0122
0.0094	0.1587	0.0323	0.0096
0.0068	0.1208	0.0300	0.0071
0.0056	0.1035	0.0293	0.0059

ksf = 1000 square feet

NASA AMES DEVELOPMENT PLAN

Development of Construction Emission Factors
Alternative 3

Development Data and Emission Factors for Construction of Land Use Types Associated with the NASA/AMES Research Park Plan - Conformity Analysis.

		Emission Factors				
Land Use Type		*ROG*	*CO*	*NOx*	*PM10*	*Units*
Dormitory/Housing		22.0	70.2	322.9	22.93	lbs/1000 ft^2
Hotel		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Museum/Exhibit Space		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Office Park		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Research & Development		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Retail		31.8	101.6	467.0	33.2	lbs/1000 ft^2
University		47.0	150.2	690.5	49.0	lbs/1000 ft^2

Yearly Adjustment Factors

Year	ROG	CO	NOx	PM
1990	1.08	1.08	1.08	1.08
1995	0.90	0.83	0.89	0.84
2000	0.72	0.59	0.72	0.60
2005	0.57	0.47	0.60	0.50
2010	0.40	0.43	0.46	0.39
2015	0.29	0.40	0.35	0.29
2020	0.24	0.39	0.30	0.24

Total Emissions in Tons Throughout Construction Period

Use	**Size**	**Units**	***ROG***	***NOx***	***CO***	***PM10***
NRP Area:						-
Educational Uses	840	ksf	20	290	63	21
Computer Museum	70	ksf	1	21	5	2
CASC	390	ksf	11	159	35	11
Coference Center & Gym	250	ksf	5	76	17	5
Housing (188 800f^2 units)	150	ksf	2	24	5	2
Housing (300 1200f^2 units)	360	ksf	4	58	13	4
Office High Density R&D	1427	ksf	40	581	126	41
Retail and Support	75	ksf	1	18	4	1
Ames Campus Area						
No Uses Under this Alt.	0	ksf	-	-	-	-
Eastside Airfield Area						
Office High Density R&D	0	ksf	-	-	-	-
Low Density R&D	781	ksf	22	318	69	23
Disaster Training	0	ksf	-	-	-	-
Bay View Area						
No Uses Under this Alt.	0	ksf	-			-
			-	-	-	-
Total Uncontrolled	4343		105	1546	336	110
Adjust for New 1990 Factors			114	1669	363	119
Adjust for future years	**2002**		**69**	**1036**	**182**	**60**
	2005		**60**	**927**	**158**	**59**
	2010		**42**	**711**	**145**	**46**
	2015		**31**	**541**	**134**	**34**
	2020		**25**	**464**	**131**	**28**

ksf = 1000 square feet

Annual Emission Factor (tons per 1000 square foot) Assuming 10-year Build Out

ROG	NOx	CO	PM
0.0160	0.2385	0.0418	0.0139
0.0138	0.2136	0.0364	0.0136
0.0097	0.1637	0.0333	0.0106
0.0070	0.1246	0.0310	0.0079
0.0058	0.1068	0.0302	0.0066

NASA AMES DEVELOPMENT PLAN

Development of Construction Emission Factors

Alternative 4

Development Data and Emission Factors for Construction of Land Use Types Associated with the NASA/AMES Research Park Plan - Conformity Analysis.

		Emission Factors				
Land Use Type		*ROG*	*CO*	*NOx*	*PM10*	*Units*
Dormitory/Housing		22.0	70.2	322.9	22.93	lbs/1000 ft^2
Hotel		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Museum/Exhibit Space		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Office Park		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Research & Development		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Retail		31.8	101.6	467.0	33.2	lbs/1000 ft^2
University		47.0	150.2	690.5	49.0	lbs/1000 ft^2

Yearly Adjustment Factors

Year	ROG	CO	NOx	PM	
1990	1.08	1.08	1.08	1.08	1.08
1995	0.90	0.83	0.89	0.84	
2000	0.72	0.59	0.72	0.60	
2005	0.57	0.47	0.60	0.50	
2010	0.40	0.43	0.46	0.39	
2015	0.29	0.40	0.35	0.29	
2020	0.24	0.39	0.30	0.24	

Total Emissions in Tons Throughout Construction Period

Use	**Size**	**Units**	***ROG***	***NOx***	***CO***	***PM10***
NRP Area:						
Educational Uses	800	ksf	19	276	60	20
Computer Museum	70	ksf	1	21	5	2
CASC	390	ksf	11	159	35	11
Coference Center & Gym	185	ksf	4	57	12	4
Housing (144 800f^2 units)	115	ksf	1	19	4	1
Housing (220 1200f^2 units)	265	ksf	3	43	9	3
Office High Density R&D	202	ksf	6	82	18	6
Retail and Support	35	ksf	1	8	2	1
Ames Campus Area						
No Uses Under this Alt.	0	ksf	-	-	-	-
Eastside Airfield Area						
Office High Density R&D	480	ksf	13	196	43	14
Low Density R&D	891	ksf	25	363	79	26
Disaster Training	80	ksf	2	28	6	2
Bay View Area						
Educational/Child Care Uses	300	ksf	7	104	23	7
Housing (550 1200f^2 units)	660	ksf	7	107	23	8
Office High Density R&D	1540	ksf	43	627	136	45
Low Density R&D	200	ksf	6	81	18	6
Total Uncontrolled	6213		148	2170	472	154
Adjust for New 1990 Factors			159	2343	510	166
Adjust for future years	**2002**		**97**	**1454**	**255**	**83**
	2005		**84**	**1302**	**222**	**72**
	2010		**59**	**998**	**203**	**66**
	2015		**43**	**759**	**189**	**62**
	2020		**35**	**651**	**184**	**60**

ksf = 1000 square feet

Annual Emission Factor (tons per 1000 square foot) Assuming 10-year Build Out

ROG	NOx	CO	PM10
0.0157	0.2340	0.0410	0.0134
0.0135	0.2095	0.0357	0.0117
0.0095	0.1607	0.0327	0.0107
0.0069	0.1222	0.0304	0.0099
0.0057	0.1048	0.0296	0.0097

NASA AMES DEVELOPMENT PLAN

Development of Construction Emission Factors
Alternative 5

Development Data and Emission Factors for Construction of Land Use Types Associated with the NASA/AMES Research Park Plan - Conformity Analysis.

		Emission Factors				
Land Use Type		*ROG*	*CO*	*NOx*	*PM10*	*Units*
Dormitory/Housing		22.0	70.2	322.9	22.93	lbs/1000 ft^2
Hotel		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Museum/Exhibit Space		41.6	132.9	611.0	43.4	lbs/1000 ft^2
Office Park		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Research & Development		55.4	177.2	814.7	57.9	lbs/1000 ft^2
Retail		31.8	101.6	467.0	33.2	lbs/1000 ft^2
University		47.0	150.2	690.5	49.0	lbs/1000 ft^2

Yearly Adjustment Factors

Year	ROG	CO	NOx	PM	
1990	1.08	1.08	1.08	1.08	1.08
1995	0.90	0.83	0.89	0.84	
2000	0.72	0.59	0.72	0.60	
2005	0.57	0.47	0.60	0.50	
2010	0.40	0.43	0.46	0.39	
2015	0.29	0.40	0.35	0.29	
2020	0.24	0.39	0.30	0.24	

Total Emissions in Tons Throughout Construction Period

Use	**Size**	**Units**	***ROG***	***NOx***	***CO***	***PM10***
NRP Area:						
Educational Uses	968	ksf	23	334	73	24
Computer Museum	120	ksf	2	37	8	3
CASC	500	ksf	14	204	44	14
Coference Center & Gym	275	ksf	6	84	18	6
Housing (290 800f^2 units)	232	ksf	3	37	8	3
Office High Density R&D	449	ksf	12	183	40	13
Retail and Support	77	ksf	1	18	4	1
Ames Campus Area						
Office High Density R&D	500	ksf	14	204	44	14
Eastside Airfield Area						
Control Tower	12	ksf	0	5	1	0
Bay View Area						
Housing (750 1200f^2 units)	900	ksf	10	145	32	10
Retail and Support	100	ksf	2	23	5	2
Total Uncontrolled	4133		87	1274	277	90
Adjust for New 1990 Factors			94	1376	299	98
Adjust for future years	**2002**		**57**	**854**	**150**	**49**
	2005		**49**	**764**	**130**	**43**
	2010		**35**	**586**	**119**	**39**
	2015		**25**	**446**	**111**	**36**
	2020		**21**	**382**	**108**	**35**

Annual Emission Factor (tons per 1000 square foot) Assuming 10-year Build Out

ROG	NOx	CO	PM10
0.0138	0.2065	0.0362	0.0118
0.0120	0.1850	0.0315	0.0103
0.0084	0.1418	0.0288	0.0094
0.0061	0.1079	0.0268	0.0088
0.0050	0.0925	0.0261	0.0085

ksf = 1000 square feet

NASA AMES DEVELOPMENT PLAN
PM10 Construction Emissions

General Construction (e.g., grading and other ground disturbance)

Alternative	Total Developable Acreage	Years of Construction	Daily PM10 Emissions (pounds per day)	Annual PM10 Emissions (tons per year)*
Alt. 2	192	10	979	125.1
Alt. 3	125	10	638	81.4
Alt. 4	219	10	1117	142.7
Alt. 5	190	10	969	123.8

* Assumes active construction occurring 70% of time

Equipment and Vehicle Exhaust

Alternative	Annual Area of Construction (1000s ft^2)	Years of Construction	Maximum PM10 Exhaust Emissions (tons per year)
Alt. 2	5193	10	6.7
Alt. 3	4343	10	5.9
Alt. 4	6213	10	7.8
Alt. 5	4133	10	4.5

Demolition Activities

Alternative	Total floor Area of Demolition (1000s ft^3)	Years of Demolition	Total PM10 Emissions (tons per year)
Alt. 2	5169	5	0.2
Alt. 3	5169	5	0.2
Alt. 4	5169	5	0.2
Alt. 5	9169	5	0.4

Emission factors based on BAAQMD CEQA Guidelines:

Dust = 51 pounds per acre per day

Equipment exhaust varies by land use type

Demolition = 0.00042 pounds per ft^3 demolished

Total

Alternative	Annual Area of Construction (1000s ft^2)	Maximum PM10 Exhaust Emissions (tons per year)
Alt. 2	5193	132.0
Alt. 3	4343	87.6
Alt. 4	6213	150.7
Alt. 5	4133	128.7

NASA AMES DEVELOPMENT PL.AN

Future Year Construction Emission Adjustment Factors

Year	ROG	CO	NOX	PM
1990	1.00	1.00	1.00	1.00
1995	0.83	0.77	0.83	0.78
2000	0.66	0.55	0.67	0.55
2005	0.53	0.44	0.55	0.47
2010	0.37	0.39	0.42	0.36
2015	0.27	0.37	0.32	0.27
2020	0.22	0.36	0.28	0.23

Developed from tables below

Increase by 8%

Year	ROG	CO	NOX	PM
1990	1.08	1.08	1.08	1.08
1995	0.90	0.83	0.89	0.84
2000	0.72	0.59	0.72	0.60
2005	0.57	0.47	0.60	0.50
2010	0.40	0.43	0.46	0.39
2015	0.29	0.40	0.35	0.29
2020	0.24	0.39	0.30	0.24

Offroad Construction Equipment (Statewide)

Year	Population	ROG	CO	NOX	PM
1990	153729	49.12	223.94	448.50	32.43
1995	161089	43.81	182.82	389.95	26.79
2000	168448	38.51	141.70	331.41	21.14
2005	180482	32.93	120.24	295.20	19.48
2010	188114	23.30	111.37	229.64	15.49
2015	193493	16.92	106.79	169.84	12.02
2020	195188	13.78	105.25	141.74	9.86

Factors (unit pounds per day)

ROG	CO	NOX	PM
0.64	2.91	5.83	0.42
0.54	2.27	4.84	0.33
0.46	1.68	3.93	0.25
0.36	1.33	3.27	0.22
0.25	1.18	2.44	0.16
0.17	1.10	1.76	0.12
0.14	1.08	1.45	0.10

***emissions in tons per day**

Construction Equip. Adjustment Factors

Year	ROG	CO	NOX	PM
1990	1.00	1.00	1.00	1.00
1995	0.85	0.78	0.83	0.79
2000	0.72	0.58	0.67	0.59
2005	0.57	0.46	0.56	0.51
2010	0.39	0.41	0.42	0.39
2015	0.27	0.38	0.30	0.29
2020	0.22	0.37	0.25	0.24

These account for about 86% of construction activity emissions

Heavy Duty Trucks (Santa Clara County)

Year	VMTx1000	ROG	CO	NOX	PM
1990	852000	2.91	23.60	16.96	1.86
1995					
2000	905000	1.09	9.00	11.02	0.58
2005	960000	0.91	8.57	9.49	0.40
2010	1066000	0.90	9.32	9.63	0.36
2015	1173000	0.94	10.18	10.28	0.36
2020	1279000	1.01	11.11	11.13	0.39

Factors (unit pounds per mi)

ROG	CO	NOX	PM
0.007	0.055	0.040	0.004
0.002	0.020	0.024	0.001
0.002	0.018	0.020	0.001
0.002	0.017	0.018	0.001
0.002	0.017	0.018	0.001
0.002	0.017	0.017	0.001

HDT Adjustment Factors

Year	ROG	CO	NOX	PM
1990	1.00	1.00	1.00	1.00
1995	0.70	0.70	0.80	0.70
2000	0.35	0.36	0.61	0.29
2005	0.28	0.32	0.50	0.19
2010	0.25	0.32	0.45	0.15
2015	0.23	0.31	0.44	0.14
2020	0.23	0.31	0.44	0.14

These account for 14% of construction activity emissions

Table 9-1. Screening Table for Estimating Total Construction Emissions**

LAND USE	UNIT OF MEASURE	EMISSION FACTORS LBS/CONSTRUCTION PERIOD			
		ROC	NO_x	CO	PM10
RESIDENTIAL					
Single Family Housing	1,000 sq. ft. GFA*	23.66	347.74	75.62	24.69
Apartments	1,000 sq. ft. GFA	21.97	322.90	70.22	22.93
Condominiums	1,000 sq. ft. GFA	21.30	312.97	68.06	22.22
Mobile Homes	1,000 sq. ft. GFA	21.30	312.97	68.06	22.22
EDUCATION					
Schools	1,000 sq. ft. GFA	46.99	690.52	150.16	49.03
COMMERCIAL					
Business Park	1,000 sq. ft. GFA	55.44	814.72	177.17	57.85
Day Care Center	1,000 sq. ft. GFA	31.87	466.97	101.55	33.16
Discount Store	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
Fast Food	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
Government Office Complex	1,000 sq. ft. GFA	55.44	814.72	177.17	57.85
Hardware Store	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
Hotel	1,000 sq. ft. GFA	41.58	611.04	132.87	43.39
Medical Office	1,000 sq. ft. GFA	55.44	814.72	177.17	57.85
Motel	1,000 sq. ft. GFA	41.58	611.04	132.87	43.39
Movie Theatre	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
Office	1,000 sq. ft. GFA	55.44	814.72	177.17	57.85
Resort Hotel	1,000 sq. ft. GFA	41.58	611.04	132.87	43.39
Restaurant	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
Shopping Center	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
Supermarket	1,000 sq. ft. GFA	31.78	466.97	101.55	33.16
INDUSTRIAL	1,000 sq. ft. GFA	32.79	481.88	104.79	34.22

* GFA = GROSS FLOOR AREA

**Construction emissions include on-site construction equipment and workers' travel.

E = (((Project square footage/1,000) × (Table 9-1 emission factor))/(Number of days to construct)
E = Daily construction emissions

For on-site construction equipment and material handling construction emissions, subtract emissions obtained by using screening Table 9-3.

For on-site construction equipment emissions, subtract emissions obtained by using screening Tables 9-3 and 9-4.

Refer to Appendix 9 for methodologies and assumptions used in preparing this table.

These emissions were estimated using energy consumption values provided in Energy and Labor in the Construction Sector, B. Hannon, R. Stein, and D. Serber, Science, 1978, 202:837–847.

Source: 1993. CEQA Air Quality Handbook, South Coast Air Quality Management District. April

NASA AMES DEVELOPMENT PLAN EMISSION FACTORS

Daily Operational Emissions (Area & Mobile)

9-Oct-01 Emissions in pounds per day

	2010 Build Out = 75%			2015 Build Out = 100%		
	ROG	NOx	PM10	ROG	NOx	PM10
Alt 2						
Area	1.6	32.9	0.0	2.2	43.8	0
Mobile	84.6	219.8	107.9	75.2	255.1	143.9
Total	86.2	252.7	107.9	77.4	298.9	143.9
Alt 3						
Area	1.2	27.9	0.0	1.6	37.3	0
Mobile	61.8	160.6	78.8	55	186.4	105.1
Total	63.0	188.5	78.8	56.6	223.7	105.1
Alt 4						
Area	2.5	36.2	0.0	3.3	48.2	0
Mobile	104	271	133	93	315	177
Total	106.5	307.2	133.0	96.3	363.2	177.0
Alt 5						
Area	2.1	38.2	0.0	2.7	51.0	0
Mobile	60	155	76	53	179	101
Total	62.1	193.2	76.0	55.7	230.0	101.0

NASA AMES DEVELOPMENT PLAN

Total Annual Operational Emissions by Alternative

Emissions in tons per year

	2003				2005 100% Build out				2010 100% Build out				2015 100% Build out				2020 100% Build out			
Scenario	ROG	NOx	CO	PM10	ROG	NOx	CO	PM10	ROG	NOx	CO	PM10	ROG	NOx	CO	PM10	ROG	NOx	CO	PM10
Alternative 1																				
Area Sources					0.3	6.6	1.0	0.0	0.3	6.6	1.0	0.0	0.3	6.6	1.0	0.0	0.3	6.6	1.0	0.0
Mobile Sources (Sat)					0.2	0.3	4.4	0.1	0.1	0.3	2.8	0.1	0.1	0.2	1.9	0.1	0.1	0.2	1.6	0.1
Mobile Sources (Sun)					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mobile Sources (WD)					5.7	11.1	142.5	4.3	3.3	8.6	90.1	4.3	2.2	7.6	61.4	4.3	1.7	7.2	50.8	4.3
TOTAL					6.2	18.0	147.9	4.4	3.7	15.5	93.9	4.4	2.6	14.4	64.4	4.4	2.1	14.0	53.3	4.4
Mobile					5.88	11.43	146.90	4.39	3.43	8.91	92.93	4.39	2.26	7.80	63.35	4.39	1.80	7.40	52.35	4.39
Alternative 2																				
Area Sources					0.4	8.0	4.0	0.0	0.4	8.0	4.0	0.0	0.4	8.0	4.0	0.0	0.4	8.0	4.0	0.0
Mobile Sources (Sat)					4.0	7.7	99.5	3.0	2.3	6.0	62.9	3.0	1.5	5.3	42.9	3.0	1.2	5.0	35.4	3.0
Mobile Sources (Sun)					3.7	7.2	92.7	2.8	2.2	5.6	58.7	2.8	1.4	4.9	40.0	2.8	1.1	4.7	33.0	2.8
Mobile Sources (WD)					22.8	44.4	570.7	17.1	13.3	34.6	361.0	17.1	8.8	30.3	246.1	17.1	7.0	28.7	203.4	17.1
TOTAL					30.9	67.4	766.9	22.8	18.2	54.3	486.6	22.8	12.1	48.5	333.0	22.8	9.8	46.4	275.9	22.8
Mobile					30.52	59.36	762.89	22.82	17.82	46.27	482.62	22.82	11.73	40.49	329.01	22.82	9.37	38.42	271.86	22.82
Alternative 3																				
Area Sources					0.3	6.8	4.0	0.0	0.3	6.8	4.0	0.0	0.3	6.8	4.0	0.0	0.3	6.8	4.0	0.0
Mobile Sources (Sat)					3.3	6.5	83.1	2.5	1.9	5.0	52.6	2.5	1.3	4.4	35.9	2.5	1.0	4.2	29.6	2.5
Mobile Sources (Sun)					3.1	5.9	76.3	2.3	1.8	4.6	48.3	2.3	1.2	4.1	32.9	2.3	0.9	5.8	27.2	2.3
Mobile Sources (WD)					16.7	32.4	417.0	12.5	9.7	25.3	263.8	12.5	6.4	22.1	179.8	12.5	5.1	21.0	148.6	12.5
TOTAL					23.4	51.6	580.4	17.2	13.8	41.8	368.7	17.2	9.2	37.4	252.6	17.2	7.4	37.8	209.4	17.2
Mobile					23.06	44.85	576.45	17.24	13.47	34.96	364.67	17.24	8.86	30.59	248.60	17.24	7.08	30.97	205.42	17.24
Alternative 4																				
Area Sources					0.6	8.8	4.0	0.0	0.6	8.8	4.0	0.0	0.6	8.8	4.0	0.0	0.6	8.8	4.0	0.0
Mobile Sources (Sat)					4.6	9.0	115.6	3.5	2.7	7.0	73.1	3.5	1.8	6.1	49.8	3.5	1.4	5.8	41.2	3.5
Mobile Sources (Sun)					4.2	8.2	104.8	3.1	2.4	6.4	66.3	3.1	1.6	5.6	45.2	3.1	1.3	5.3	37.3	3.1
Mobile Sources (WD)					28.1	54.7	703.6	21.0	16.4	42.7	445.1	21.0	10.8	37.3	303.5	21.0	8.6	35.4	250.7	21.0
TOTAL					37.6	80.7	927.9	27.6	22.2	64.8	588.5	27.6	14.8	57.8	402.5	27.6	11.9	55.3	333.3	27.6
Mobile					36.96	71.89	923.95	27.63	21.58	56.04	584.51	27.63	14.21	49.03	398.47	27.63	11.35	46.53	329.26	27.63
Alternative 5																				
Area Sources					0.5	9.3	4.0		0.5	9.3	4.0		0.5	9.3	4.0		0.5	9.3	4.0	
Mobile Sources (Sat)					4.0	7.8	100.4	3.0	2.3	6.1	63.5	3.0	1.5	5.3	43.3	3.0	1.2	5.1	35.8	3.0
Mobile Sources (Sun)					4.1	7.9	101.4	3.0	2.4	6.2	64.2	3.0	1.6	5.4	43.7	3.0	1.2	5.1	36.1	3.0
Mobile Sources (WD)					16.1	31.2	401.2	12.0	9.4	24.3	253.8	12.0	6.2	21.3	173.0	12.0	4.9	20.2	143.0	12.0
TOTAL					24.6	56.2	607.1	18.0	14.6	45.9	385.5	18.0	9.8	41.3	264.1	18.0	7.9	39.7	218.9	18.0
Mobile					24.13	46.92	603.08	18.04	14.09	36.58	381.52	18.04	9.27	32.00	260.09	18.04	7.41	30.37	214.91	18.04

NASA AMES DEVELOPMENT PLAN

Mobile Sources

Total Emissions in Tons Per Day for all of Santa Clara County based on CARB MVEIG BURDEN Report

	Tons Per Day Emissions											
	2005			2010			2015			2020		
Pollutant Factor	W	S	Weighted	W	S	Weighted	W	S	Weighted	W	S	Weighted
ROG												
Exhaust	9.22	9.45	**9.34**	5.19	5.39	**5.29**	3.5	3.62	**3.56**	3.05	3.14	**3.10**
RunLoss	3.59	4.25	**3.92**	2.9	3.53	**3.22**	2.43	3.03	**2.73**	2.26	2.84	**2.55**
Start	15.52	9.54	**12.53**	8.8	5.69	**7.25**	5.23	3.67	**4.45**	3.7	2.76	**3.23**
HotSoak	5.05	2.98	**4.02**	3.7	2.18	**2.94**	2.88	1.7	**2.29**	2.61	1.54	**2.08**
NOx												
Exhaust	40.04	37.28	**38.66**	33.32	31.27	**32.30**	31.23	29.47	**30.35**	31.67	29.96	**30.82**
Start	11.51	10.09	**10.80**	10.22	8.94	**9.58**	9.67	8.45	**9.06**	9.82	8.57	**9.20**
CO												
Exhaust	172.43	178.04	**175.24**	146.28	151.76	**149.02**	132.48	137.65	**135.07**	134.38	139.65	**137.02**
Start	181.38	97.89	**139.64**	119.93	70.25	**95.09**	83.93	54.93	**69.43**	72.02	50.35	**61.19**
PM10												
Exhaust	1.48	1.48	**1.48**	1.49	1.49	**1.49**	1.56	1.56	**1.56**	1.67	1.67	**1.67**

	2000	2003	2005	2010	2015	2020
Burden Data						
Daily VMT			35830000	38767000	41708000	44644000
Daily Starts			8618209	9277197	9936189	10596849

Using CARB Defaults W = winter, S = summer VMT = vehicle miles travelled

Note: MVEIG BURDEN is the motor vehicle emissions inventory model developed and used by the California Air Resources Board to predict county-wide emissions inventories for future years

NASA AMES DEVELOPMENT PLAN EMISSION FACTORS

On-Road Motor Vehicle Emission Factors

Santa Clara County

	2000	2003	2005	2010	2015	2020
Burden Info						
Daily VMT (county-wide)			35830000	38767000	41708000	44644000
Daily Starts (county-wide)			8618209	9277197	9936189	10596849

VMT =
6.9 mi in 2000 through 2015

	Weekday		Saturday		Sunday	
Project Info	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Alt 1 Trips	5934	5371	694	680	0	0
Alt 2 Trips	33527	21517	16649	15233	13159	11960
Alt 3 Trips	24406	15721	13831	12734	10763	9845
Alt 4 Trips	41148	26528	19386	17699	14916	13514
Alt 5 Trips	27790	15127	17031	15385	14525	13080

Percent of Weekday Trips

	Saturday		Sunday	
	Unmitigated	Mitigated	Unmitigated	Mitigated
Alt 1 Trips	12%	**13%**	0%	**0%**
Alt 2 Trips	50%	**71%**	39%	**56%**
Alt 3 Trips	57%	**81%**	44%	**63%**
Alt 4 Trips	47%	**67%**	36%	**51%**
Alt 5 Trips	61%	**102%**	52%	**86%**

In typical year -
Saturdays = 52 + ~5 = 57 (16%)
Sundays = 52+12 = 69 (19%)
Weekdays 365 -(57+69) = 239 (65%)

Pollutant Factor	Emissions in tons per day for entire county				
ROG					
Exhaust		9.34	5.29	3.56	3.10
RunLoss		3.92	3.22	2.73	2.55
Start		12.53	7.25	4.45	3.23
HotSoak		4.02	2.94	2.29	2.08
NOx					
Exhaust		38.66	32.30	30.35	30.82
Start		10.80	9.58	9.06	9.20
CO					
Exhaust		175.24	149.02	135.065	137.02
Start		139.64	95.09	69.43	61.19
PM10					
Exhaust		1.48	1.49	1.56	1.67

Emission Factors (in grams/mile or grams/start)

Pollutant Factor		2000	2003	2005	2010	2015	2020
ROG							
Exhaust	grams/mi			0.24	0.12	0.08	0.06
RunLoss	grams/mi			0.10	0.08	0.06	0.05
Start	grams/start			1.32	0.71	0.41	0.28
HotSoak	grams/start			0.42	0.29	0.21	0.18
NOx							
Exhaust	grams/mi			0.98	0.76	0.66	0.63
Start	grams/start			1.14	0.94	0.83	0.79
CO							
Exhaust	grams/mi			4.44	3.49	2.94	2.79
Start	grams/start			14.71	9.31	6.34	5.24
PM10							
Exhaust, Reintrained	grams/mi			0.44	0.44	0.44	0.44

Conversion Factors
pounds to tons = /2000
grams to pounds = *454

Note: County-wide mobile source emissions in tons per day were converted to unit emission factors (in grams per mile or grams per day) using county-wide vehicle activity (I.e., daily vehicle miles traveled and daily vehicle starts).