LIST OF PUBLICATIONS PRODUCED

White, J.J., Carroll, J.N., and Andreoni, T., "Three-Way Catalyst Technology for Off-Road Equipment Engines," SAE Paper to be presented at Small Engine Technology Conference, Madison, Wisconsin, September 1999.

GLOSSARY OF TERMS, ABBREVIATIONS, AND SYMBOLS

λ	(Actual A/F) / (stoichiometric A/F)
A/F	Air/fuel ratio
AECI	Automotive Emissions Control International, Inc.
AFR	Air/fuel ratio
ARB	Air Resources Board
ASEC	AlliedSignal Environmental Catalysts
BSFC	Brake-specific fuel consumption
BTDC	Before top dead center
C2	Seven-mode test cycle
CARB	California Air Resources Board
cfm	Cubic feet per minute
CH_4	Methane
CID	Cubic inch displacement
CL	Closed-loop
CLC	Closed-loop control
CNG	Compressed natural gas
CO	Carbon monoxide
D&D	Design and development
D2	Five-mode test cycle
DC	Direct current
DF	Deterioration factor
DIS	Distributor-less ignition system
ECM	Electronic engine control module
ECS	Emission Control Systems, Ltd.
ECU	Engine control unit
EEA	Energy and Environmental Analysis, Inc.
EFI	Electronic fuel injection
EGO	Exhaust gas oxygen sensor
EGR	Exhaust gas recirculation
EMA	Engine Manufacturers Association
EPA	U.S. Environmental Protection Agency
FCV	Fuel control valve
g/hp-hr	Grams per horsepower - hour
GM	General Motors
GSE	Airport ground support equipment
HC	Hydrocarbon
HD5	Commercial grade of LPG
HP	Horsepower
Hz	Hertz
IC	Internal combustion
In. Hg	Inches of mercury
ISO	International Standards Organization
ITA	Industrial Truck Association
L	Liter

GLOSSARY OF TERMS, ABBREVIATIONS, AND SYMBOLS (CONT'D)

lb/hp-hr	Pounds per horsepower - hour
LEV	Low emission vehicle
LNG	Liquified natural gas
LPG	Liquified petroleum gas
LSI	Large spark-ignited
M11	CARB SIP measure for non-preempted industrial equipment
M12	CARB SIP measure for preempted industrial equipment
MAP	Manifold absolute pressure
MBT	Minimum advance for best torque
MECA	Manufacturers of Emission Controls Association
mg/hp-hr	Milligrams per horsepower - hour
N/A	Not applicable
NEVES	EPA Non-Road Equipment and Vehicle Emission Study
NG	Natural gas
NMHC	Non-methane hydrocarbon
NO_x	Oxides of nitrogen
OEM	Original equipment manufacturer
PC	Personal computer
RFP	Request for proposal
ROG	Reactive organic gases
RPE	Retail price equivalent
RPM	Revolutions per minute
SAE	Society of Automotive Engineers
SCAB	South Coast Air Basin
SI	Spark ignited
SIP	State Implementation Plan
SwRI	Southwest Research Institute
TAC	Technical Advisory Committee
TBI	Throttle body injection
TEC	Total engine control
THC	Total hydrocarbon
TPS	Throttle position sensor
TWC	Three-way catalyst
UL	Underwriters Laboratories
ULEV	Ultra-low emission vehicle
WOT	Wide-open-throttle
ZEEMS	Zenith Electronic Engine Management System

APPENDIX A

POPULATION, USAGE, AND EMISSIONS CALCULATIONS

Table No.	Description
A-1	Population, Usage, and Emissions Calculations for Non-Preempted Industrial Equipment
A-2	Population, Usage, and Emissions Calculations for Offroad LPG and Gasoline Equipment
A-3	Population-Weighted Average Usage Information for all (Preempted plus Non-Preempted) Equipment
A-4	2010 Uncontrolled Emission Inventory for Non-Preempted 25-175hp LPG and Gasoline Offroad (Industrial) Equipment
A-5	2010 Uncontrolled Emission Inventory for Preempted 25-175hp Offroad LPG and Gasoline Equipment
A-6	2010 Emission Inventory for Non-Preempted 25-175hp LPG and Gasoline Offroad (Industrial) Equipment with Control Technology
A-7	2010 Emission Inventory for Preempted 25-175hp Offroad LPG & Gasoline Equipment with Control Technology

TABLE A-1. POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR NON-PREEMPTED INDUSTRIAL EQUIPMENT

2010 Population and Usage Data for 25-175hp Non-preempted (Industrial) Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	All
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	Total
3020	**Forklifts**									
	Population	4034			1376			4034	1376	5410
	Average hp	41			41			41	41	41
	Use Hours	1800			1800			1800	1800	1800
	Load Factor	0.3			0.3			0.30	0.30	0.30
	Useful Life	3			3			3	3	3
3030	**Sweepers/Scrubbers**									
	Population				909	759	4		1672	1672
	Average hp				35	68	140		50	50
	Use Hours				516	516	516		516	516
	Load Factor				0.71	0.71	0.71		0.71	0.71
	Useful Life				3	16	1		9	9
3040	**Other General Industrial Equipment**									
	Population				311	102	10		423	423
	Average hp				30	79	174		45	45
	Use Hours				713	713	713		713	713
	Load Factor				0.54	0.54	0.54		0.54	0.54
	Useful Life				4	4	3		4	4
3050	**Other Material Handling Equipment**									
	Population				4	195	0		199	199
	Average hp				41	54			54	54
	Use Hours				386	386			386	386
	Load Factor				0.53	0.53			0.53	0.53
	Useful Life				6	16			16	16
6005	**Generator Sets**									
	Population		215	178	14925	2882	272	393	18079	18472
	Average hp		83	146	32	83	146	112	42	43
	Use Hours		115	115	115	115	115	115	115	115
	Load Factor		0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
	Useful Life		16	16	16	16	16	16	16	16
8015	**A/C Tug, narrow Body**									
	Population						61		61	61
	Average hp						130		130	130
	Use Hours						551		551	551
	Load Factor						0.8		0.80	0.80
	Useful Life						7		7	7

TABLE A-1 (CONT'D). POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR NON-PREEMPTED INDUSTRIAL EQUIPMENT

2010 Population and Usage Data for 25-175hp Non-preempted (Industrial) Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	All
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	Total
8035	**Baggage Tug**									
	Population		126			912		126	912	1038
	Average hp		100			100		100	100	100
	Use Hours		876			876		876	876	876
	Load Factor		0.55			0.55		0.55	0.55	0.55
	Useful Life		6			6		6	6	6
8040	**Belt Loader**									
	Population		27			430		27	430	457
	Average hp		60			60		60	60	60
	Use Hours		810			810		810	810	810
	Load Factor		0.5			0.5		0.50	0.50	0.50
	Useful Life		7			7		7	7	7
8045	**Bobtail**									
	Population		3			130		3	130	133
	Average hp		100			100		100	100	100
	Use Hours		6			876		6	876	856
	Load Factor		0.55			0.55		0.55	0.55	0.55
	Useful Life		6			6		6	6	6
8050	**Cargo Loader**									
	Population		7			131		7	131	138
	Average hp		70			70		70	70	70
	Use Hours		8			719		8	719	683
	Load Factor		0.5			0.5		0.50	0.50	0.50
	Useful Life		8			8		8	8	8
8060	**Deicer**									
	Population					40			40	40
	Average hp					93			93	93
	Use Hours					22			22	22
	Load Factor					0.95			0.95	0.95
	Useful Life					16			16	16
8065	**Forklift**									
	Population	289			124			289	124	413
	Average hp	50			50			50	50	50
	Use Hours	6			726			6	726	222
	Load Factor	0.3			0.3			0.30	0.30	0.30
	Useful Life	6			6			6	6	6

TABLE A-1 (CONT'D). POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR NON-PREEMPTED INDUSTRIAL EQUIPMENT

2010 Population and Usage Data for 25-175hp Non-preempted (Industrial) Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	All
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	Total
8075	**Ground Power Unit**									
	Population						101		101	101
	Average hp						150		150	150
	Use Hours						796		796	796
	Load Factor						0.75		0.75	0.75
	Useful Life						5		5	5
8090	**Lift**									
	Population		8			198		8	198	206
	Average hp		100			100		100	100	100
	Use Hours		376			376		376	376	376
	Load Factor		0.5			0.5		0.50	0.50	0.50
	Useful Life		16			16		16	16	16
8100	**Other**									
	Population	25			226			25	226	251
	Average hp	50			50			50	50	50
	Use Hours	16			183			16	183	166
	Load Factor	0.5			0.5			0.50	0.50	0.50
	Useful Life	16			16			16	16	16
Composite Non-preempted M11 Equipment								**CNG/LPG**	**Gasoline**	**All**
	Population							4912	24102	29014
	Average hp							49	47	47
	Use Hours							1515	310	514
	Load Factor							0.34	0.64	0.59
	Useful Life							4.41	14	12

References: Population: ARB 2010 California Inventory of M11 Category Equipment (Walter Wong ARB)
Usage: ARB Offroad Model

TABLE A-2. POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR OFFROAD LPG AND GASOLINE EQUIPMENT

2010 Population and Activity Data for Preempted 25-175hp Offroad LPG & Gasoline Equipment										
		Compressed Gas-4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	All
5015	**Agricultural Tractors**									
	Population					946	129		1075	1075
	Average hp					82	125		87	87
	Use Hours					550	550		550	550
	Load Factor					0.62	0.62		0.62	0.62
	Useful Life					16	16		16	16
5020	**Combines**									
	Population					237	132		369	369
	Average hp					103	164		125	125
	Use Hours					125	125		125	125
	Load Factor					0.74	0.74		0.74	0.74
	Useful Life					9	10		9	9
5025	**Balers**									
	Population				3453	1765			5218	5218
	Average hp				35	75			49	49
	Use Hours				68	68			68	68
	Load Factor				0.55	0.55			0.55	0.55
	Useful Life				16	16			16	16
5035	**Sprayers**									
	Population				650	1094	246		1990	1990
	Average hp				33	68	140		65	65
	Use Hours				80	80	80		80	80
	Load Factor				0.5	0.5	0.5		0.50	0.50
	Useful Life				16	12	16		14	14
5045	**Swathers**									
	Population					3540	2712		6252	6252
	Average hp					88	129		106	106
	Use Hours					95	95		95	95
	Load Factor					0.52	0.52		0.52	0.52
	Useful Life					16	12		14	14
5050	**Hydro Power Units**									
	Population				33	4			37	37
	Average hp				38	66			41	41
	Use Hours				450	450			450	450
	Load Factor				0.56	0.56			0.56	0.56
	Useful Life				5	3			5	5

TABLE A-2 (CONT'D). POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR OFFROAD LPG AND GASOLINE EQUIPMENT

2010 Population and Activity Data for Preempted 25-175hp Offroad LPG & Gasoline Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	All
5055	**Other Agricultural Equipment**									
	Population				107	621	71		799	799
	Average hp				29	67	136		68	68
	Use Hours				124	124	124		124	124
	Load Factor				0.55	0.55	0.55		0.55	0.55
	Useful Life				16	15	9		15	15
2003	**Asphalt Pavers**									
	Population				139	76			215	215
	Average hp				32	61			42	42
	Use Hours				392	392			392	392
	Load Factor				0.66	0.66			0.66	0.66
	Useful Life				5	16			9	9
2015	**Rollers**									
	Population				96	183			279	279
	Average hp				37	75			62	62
	Use Hours				621	621			621	621
	Load Factor				0.62	0.62			0.62	0.62
	Useful Life				16	16			16	16
2021	**Paving Equipment**									
	Population				376	96			472	472
	Average hp				37	66			43	43
	Use Hours				175	175			175	175
	Load Factor				0.59	0.59			0.59	0.59
	Useful Life				13	8			12	12
2030	**Trenchers**									
	Population				884	293			1177	1177
	Average hp				30	66			39	39
	Use Hours				402	402			402	402
	Load Factor				0.66	0.66			0.66	0.66
	Useful Life				5	16			8	8
2033	**Bore/Drill Rigs**									
	Population				42	196	48		286	286
	Average hp				32	88	126		86	86
	Use Hours				107	107	107		107	107
	Load Factor				0.79	0.79	0.79		0.79	0.79
	Useful Life				16	16	16		16	16

TABLE A-2 (CONT'D). POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR OFFROAD LPG AND GASOLINE EQUIPMENT

2010 Population and Activity Data for Preempted 25-175hp Offroad LPG & Gasoline Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	All
2039	**Concrete/Industrial Saws**									
	Population				160	90			250	250
	Average hp				35	66			46	46
	Use Hours				610	610			610	610
	Load Factor				0.78	0.78			0.78	0.78
	Useful Life				3	2			3	3
2045	**Cranes**									
	Population				48	97	3		148	148
	Average hp				37	74	125		63	63
	Use Hours				415	415	415		415	415
	Load Factor				0.47	0.47	0.47		0.47	0.47
	Useful Life				6	16	16		13	13
2054	**Crushing/Proc. Equipment**									
	Population					56			56	56
	Average hp					96			96	96
	Use Hours					241			241	241
	Load Factor					0.85			0.85	0.85
	Useful Life					16			16	16
2057	**Rough Terrain Forklift**									
	Population				20	275	10		305	305
	Average hp				47	85	142		84	84
	Use Hours				413	413	413		413	413
	Load Factor				0.63	0.63	0.63		0.63	0.63
	Useful Life				4	16	3		15	15
2060	**Rubber Tired Loaders**									
	Population				48	322			370	370
	Average hp				40	72			68	68
	Use Hours				512	512			512	512
	Load Factor				0.54	0.54			0.54	0.54
	Useful Life				3	4			4	4
2066	**Tractors/Loaders/Backhoes**									
	Population					172			172	172
	Average hp					63			63	63
	Use Hours					870			870	870
	Load Factor					0.48			0.48	0.48
	Useful Life					16			16	16

TABLE A-2 (CONT'D). POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR OFFROAD LPG AND GASOLINE EQUIPMENT

2010 Population and Activity Data for Preempted 25-175hp Offroad LPG & Gasoline Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	All
2072	**Skid Steer Loaders**									
	Population				1326	794			2120	2120
	Average hp				32	80			50	50
	Use Hours				310	310			310	310
	Load Factor				0.58	0.58			0.58	0.58
	Useful Life				10	10			10	10
2078	**Dumpers/Tenders**									
	Population					35			35	35
	Average hp					66			66	66
	Use Hours					127			127	127
	Load Factor					0.41			0.41	0.41
	Useful Life					16			16	16
2081	**Other Construction Equipment**									
	Population						136		136	136
	Average hp						126		126	126
	Use Hours						371		371	371
	Load Factor						0.48		0.48	0.48
	Useful Life						6		6	6
6010	**Pumps**									
	Population				1193	1511	45		2749	2749
	Average hp				31	93	144		67	67
	Use Hours				221	221	221		221	221
	Load Factor				0.69	0.69	0.69		0.69	0.69
	Useful Life				10	16	16		13	13
6015	**Air Compressors**									
	Population				453	1470	99		2022	2022
	Average hp				35	70	134		65	65
	Use Hours				484	484	484		484	484
	Load Factor				0.56	0.56	0.56		0.56	0.56
	Useful Life				5	16	4		13	13
6025	**Welders**									
	Population				2370	2419	166		4955	4955
	Average hp				45	70	130		60	60
	Use Hours				208	208	208		208	208
	Load Factor				0.51	0.51	0.51		0.51	0.51
	Useful Life				10	16	16		13	13

TABLE A-2 (CONT'D). POPULATION, USAGE, AND EMISSIONS CALCULATIONS FOR OFFROAD LPG AND GASOLINE EQUIPMENT

2010 Population and Activity Data for Preempted 25-175hp Offroad LPG & Gasoline Equipment										
		Compressed Gas 4-Stroke (2266)			Gasoline 4-Stroke (2265)			Comp. Gas	Gasoline	
ASC	Equipment Type	50 hp	120 hp	175 hp	50 hp	120 hp	175 hp	Average	Average	All
6030	**Pressure Washers**									
	Population				132				132	132
	Average hp				29				29	29
	Use Hours				115				115	115
	Load Factor				0.85				0.85	0.85
	Useful Life				13				13	13
3010	**Aerial Lifts**									
	Population				1044	977			2021	2021
	Average hp				33	67			49	49
	Use Hours				361	361			361	361
	Load Factor				0.46	0.46			0.46	0.46
	Useful Life				8	10			9	9
3020	**Forklifts**									
	Population		14160	516		4834	176	14676	5010	19686
	Average hp		70	146		70	146	73	73	73
	Use Hours		1800	1800		1800	1800	1800	1800	1800
	Load Factor		0.3	0.3		0.3	0.3	0.30	0.30	0.30
	Useful Life		10	2		10	2	10	10	10
Population-Weighted Preempted Equipment										
								Comp. Gas	Gasoline	
ALL Preempted										
	Population							14676	38650	53326
	Average hp							73	69	69.7
	Use Hours							1800	427	804.6
	Load Factor							0.30	0.53	0.46
	Useful Life							10	13	11.9
Agricultural										
	Population							0	15740	
	Average hp							0	79	
	Use Hours							0	118	
	Load Factor							0	0.54	
	Useful Life							0	15	
Construction										
	Population							14676	22910	
	Average hp							73	62	
	Use Hours							1800	639	
	Load Factor							0.30	0.51	
	Useful Life							10	11	

TABLE A-3. POPULATION-WEIGHTED AVERAGE USAGE INFORMATION FOR ALL (PREEMPTED PLUS NON-PREEMPTED) EQUIPMENT

	Preempted		Non-preempted		Combined	
	Gasoline	Comp. Gas	Gasoline	Comp. Gas	Gasoline	Comp. Gas
Population	38650	14676	24102	4912	62752	19588
Average hp	69	73	47	49	60.27	66.74
Use Hours	427	1800	310	1515	381.85	1728.64
Load Factor	0.53	0.30	0.64	0.34	0.57	0.31
Useful Life	13	10	14	4.41	13.10	8.39

TABLE A-4. 2010 UNCONTROLLED EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT

Average Baseline Emission Factors for LPG and Gasoline 25-175hp Offroad Equipment (g/hp-hr) (Average of all cycles)								
	HC	CO	NOx					
Gasoline	6.22	203.43	7.13					
LPG	1.68	28.23	11.99					
	Forklifts	Gen. Sets	Baggage Tug	Belt Loader	Bobtail	Cargo Loader	Forklift	Lift
	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas
Activity Data								
Population	4034	393	126	27	3	7	289	8
Average hp	41	112	100	60	100	70	50	100
Use Hours	1800	115	876	810	6	8	6	376
Load Factor	0.3	0.68	0.55	0.5	0.55	0.5	0.3	0.5
Useful Life	3	16	6	7	6	8	6	16
Load-weighted Annual Usage (hp-hr)	22140	8722	48180	24300	330	280	90	18800
Emission Inventory								
HC (tons/day)	0.45	0.02	0.03	0.00	0.00	0.00	0.00	0.00
CO (tons/day)	7.61	0.29	0.52	0.06	0.00	0.00	0.00	0.01
NOx (tons/day)	3.23	0.12	0.22	0.02	0.00	0.00	0.00	0.01
HC + NOx (tons/day)	3.68	0.14	0.25	0.02	0.00	0.00	0.00	0.01
Lifetime Emissions, per eng.								
HC (tons)	0.12	0.26	0.54	0.32	0.00	0.00	0.00	0.56
CO (tons)	2.07	4.34	9.00	5.29	0.06	0.07	0.02	9.36
NOx (tons)	0.88	1.84	3.82	2.25	0.03	0.03	0.01	3.98
HC + NOx (tons)	1.00	2.10	4.36	2.57	0.03	0.03	0.01	4.54
Equipment Lifetime Emissions, total for group								
HC (tons)	496.18	101.56	67.45	8.51	0.01	0.03	0.29	4.46
CO (tons)	8337.63	1706.62	1133.43	142.91	0.18	0.49	4.86	74.88
NOx (tons)	3540.78	724.76	481.34	60.69	0.08	0.21	2.06	31.80
HC + NOx (tons)	4036.96	826.32	548.79	69.20	0.09	0.24	2.35	36.26

TABLE A-4 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT

	Other	Forklifts	Sweeper/ Scrubber	Other Gn. Industrial	Other Mat. Handling	Gen. Sets	A/C Tug	Baggage Tug
	Comp. Gas	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data								
Population	25	1376	1672	423	199	18079	61	912
Average hp	50	41	50	45	54	42	130	100
Use Hours	16	1800	516	713	386	115	551	876
Load Factor	0.5	0.3	0.71	0.54	0.53	0.68	0.8	0.55
Useful Life	16	3	9	4	16	16	7	6
Load-weighted Annual Usage (hp-hr)	400	22140	18403	17411	10994	3272	57304	48180
Emission Inventory								
HC (tons/day)	0.00	0.57	0.58	0.14	0.04	1.11	0.07	0.83
CO (tons/day)	0.00	18.72	18.90	4.52	1.34	36.34	2.15	26.99
NOx (tons/day)	0.00	0.66	0.66	0.16	0.05	1.27	0.08	0.95
HC + NOx (tons/day)	0.00	1.23	1.24	0.30	0.09	2.38	0.15	1.78
Equipment Lifetime Emissions, per eng.								
HC (tons)	0.01	0.46	1.12	0.47	1.19	0.36	2.75	1.98
CO (tons)	0.20	14.89	36.71	15.52	38.95	11.74	89.95	64.82
NOx (tons)	0.08	0.52	1.29	0.54	1.36	0.41	3.15	2.27
HC + NOx (tons)	0.09	0.98	2.41	1.01	2.55	0.77	5.90	4.25
Equipment Lifetime Emissions, total for group								
HC (tons)	0.30	626.91	1877.71	200.87	237.09	6492.81	167.84	1808.42
CO (tons)	4.98	20493.98	61383.23	6566.70	7750.71	212253.52	5486.83	59118.28
NOx (tons)	2.11	718.15	2151.00	230.11	271.60	7437.82	192.27	2071.63
HC + NOx (tons)	2.41	1345.06	4028.71	430.99	508.70	13930.63	360.11	3880.05

TABLE A-4 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT

	Belt Loader	Bobtail	Cargo Loader	Deicer	Forklift	Gr. Power Unit	Lift	Other
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data								
Population	430	130	131	40	124	101	198	226
Average hp	60	100	70	93	50	150	100	50
Use Hours	810	876	719	22	726	796	376	183
Load Factor	0.5	0.55	0.5	0.95	0.3	0.75	0.5	0.5
Useful Life	7	6	8	16	6	5	16	16
Load-weighted Annual Usage (hp-hr)	24300	48180	25165	1944	10890	89550	18800	4575
Emission Inventory								
HC (tons/day)	0.20	0.12	0.06	0.00	0.03	0.17	0.07	0.02
CO (tons/day)	6.42	3.85	2.03	0.05	0.83	5.56	2.29	0.64
NOx (tons/day)	0.22	0.13	0.07	0.00	0.03	0.19	0.08	0.02
HC + NOx (tons/day)	0.42	0.25	0.13	0.00	0.06	0.36	0.15	0.04
Equipment Lifetime Emissions, per eng.								
HC (tons)	1.17	1.98	1.38	0.21	0.45	3.07	2.06	0.50
CO (tons)	38.14	64.82	45.14	6.97	14.65	100.40	67.45	16.41
NOx (tons)	1.34	2.27	1.58	0.24	0.51	3.52	2.36	0.58
HC + NOx (tons)	2.51	4.25	2.96	0.45	0.96	6.59	4.42	1.08
Equipment Lifetime Emissions, total for group								
HC (tons)	501.72	257.78	180.90	8.53	55.58	310.20	408.54	113.48
CO (tons)	16401.43	8426.95	5913.81	278.94	1816.81	10140.65	13355.25	3709.61
NOx (tons)	574.74	295.30	207.23	9.77	63.66	355.35	468.00	129.99
HC + NOx (tons)	1076.46	553.08	388.14	18.31	119.24	665.55	876.53	243.47

TABLE A-4 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT

	All Non-preempted Equipment		
	Comp. Gas	Gasoline	Total
Activity Data			
Population	4912	24102	29014
Average hp			
Use Hours			
Load Factor			
Useful Life			
Load-weighted Annual Usage (hp-hr)			
Emission Inventory			
	Sum		
HC (tons/day)	0.51	4.00	4.50
CO (tons/day)	8.50	130.62	139.12
NOx (tons/day)	3.61	4.58	8.19
HC + NOx (tons/day)	4.12	8.58	12.69
Equipment Lifetime Emissions, per eng.			
HC (tons)			
CO (tons)			
NOx (tons)			
HC + NOx (tons)			
Equipment Lifetime Emissions, total for group			
	Population weighted average		
HC (tons)	0.14	0.55	
CO (tons)	2.32	17.97	
NOx (tons)	0.99	0.63	
HC + NOx (tons)	1.12	1.18	
	Population weighted average individual engine lifetime emissions		
HC (lb)	276	1099	
CO (lb)	4644	35939	
NOx (lb)	1972	1259	
HC + NOx (lb)	2249	2359	

TABLE A-5. 2010 UNCONTROLLED EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT

Average Baseline Emission Factors for LPG and Gasoline 25-175hp Offroad Equipment (g/hp-hr) (Average of all cycles)							
	HC	CO	NOx				
Gasoline	6.22	203.43	7.13				
LPG	1.68	28.23	11.99				
	Agr. Tractors	Combines	Balers	Sprayers	Swathers	Hydro Power Units	Oth. Agr.
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data							
Population	1075	369	5218	1990	6252	37	799
Average hp	87	125	49	65	106	41	68
Use Hours	550	125	68	80	95	450	124
Load Factor	0.62	0.74	0.55	0.50	0.52	0.56	0.55
Useful Life	16	9	16	14	14	5	15
Load-weighted Annual Usage (hp-hr)	29722	11546	1815	2619	5226	10339	4641
Emission Inventory							
HC (tons/day)	0.60	0.08	0.18	0.10	0.61	0.01	0.07
CO (tons/day)	19.63	2.62	5.82	3.20	20.07	0.24	2.28
NOx (tons/day)	0.69	0.09	0.20	0.11	0.70	0.01	0.08
HC + NOx (tons/day)	1.29	0.17	0.38	0.21	1.31	0.02	0.15
Equipment Lifetime Emissions, per engine							
HC (tons)	3.26	0.74	0.20	0.25	0.51	0.34	0.46
CO (tons)	106.64	24.23	6.51	8.10	16.72	11.09	15.19
NOx (tons)	3.74	0.85	0.23	0.28	0.59	0.39	0.53
HC + NOx (tons)	7.00	1.59	0.43	0.53	1.10	0.73	1.00
Equipment Lifetime Emissions for group							
HC (tons)	3506.60	273.47	1039.43	493.33	3196.87	12.55	371.34
CO (tons)	114632.81	8939.96	33979.40	16127.39	104507.39	410.35	12139.36
NOx (tons)	4016.98	313.28	1190.71	565.14	3662.16	14.38	425.39
HC + NOx (tons)	7523.58	586.75	2230.14	1058.47	6859.03	26.93	796.73

TABLE A-5 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT

	Trenchers	Bore/Drill Rigs	Concrete/ Ind. Saws	Cranes	Asphalt Pavers	Rollers	Paving Equip.
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data							
Population	1177	286	250	148	215	279	472
Average hp	39	86	46	63	42	62	43
Use Hours	402	107	610	415	392	621	175
Load Factor	0.66	0.79	0.78	0.47	0.66	0.62	0.59
Useful Life	8	16	3	13	9	16	12
Load-weighted Annual Usage (hp-hr)	10337	7283	21963	12295	10931	23842	4429
Emission Inventory							
HC (tons/day)	0.23	0.04	0.10	0.03	0.04	0.13	0.04
CO (tons/day)	7.47	1.28	3.37	1.12	1.44	4.09	1.28
NOx (tons/day)	0.26	0.04	0.12	0.04	0.05	0.14	0.05
HC + NOx (tons/day)	0.49	0.08	0.22	0.07	0.09	0.27	0.09
Equipment Lifetime Emissions, per engine							
HC (tons)	0.55	0.80	0.40	1.08	0.67	2.62	0.36
CO (tons)	17.94	26.13	13.00	35.17	21.79	85.54	11.90
NOx (tons)	0.63	0.92	0.46	1.23	0.76	3.00	0.42
HC + NOx (tons)	1.18	1.71	0.85	2.31	1.43	5.61	0.78
Equipment Lifetime Emissions for group							
HC (tons)	645.83	228.59	99.43	159.22	143.29	730.06	171.84
CO (tons)	21112.54	7472.75	3250.45	5205.11	4684.23	23866.05	5617.57
NOx (tons)	739.83	261.86	113.90	182.40	164.15	836.32	196.85
HC + NOx (tons)	1385.66	490.45	213.33	341.62	307.44	1566.38	368.69

TABLE A-5 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT

	Crushing/Proc. Equip.	Rough Terrain Forklifts	Rubber Tired Loaders	Tractors/ Loaders/ Backhoes	Skid Steer Loaders	Dumpers/ Tenders	Other Const.
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data							
Population	56	305	370	172	2120	35	136
Average hp	96	84	68	63	50	66	126
Use Hours	241	413	512	870	310	127	371
Load Factor	0.85	0.63	0.54	0.48	0.58	0.41	0.48
Useful Life	16	15	4	16	10	16	6
Load-weighted Annual Usage (hp-hr)	19666	21954	18759	26309	8986	3437	22438
Emission Inventory							
HC (tons/day)	0.02	0.13	0.13	0.09	0.36	0.00	0.06
CO (tons/day)	0.68	4.11	4.26	2.78	11.70	0.07	1.87
NOx (tons/day)	0.02	0.14	0.15	0.10	0.41	0.00	0.07
HC + NOx (tons/day)	0.04	0.27	0.28	0.19	0.77	0.00	0.13
Equipment Lifetime Emissions, per engine							
HC (tons)	2.16	2.23	0.50	2.89	0.62	0.38	0.92
CO (tons)	70.56	72.79	16.28	94.39	20.15	12.33	30.19
NOx (tons)	2.47	2.55	0.57	3.31	0.71	0.43	1.06
HC + NOx (tons)	4.63	4.78	1.07	6.20	1.32	0.81	1.98
Equipment Lifetime Emissions for group							
HC (tons)	120.87	679.17	184.26	496.63	1306.73	13.20	125.59
CO (tons)	3951.16	22202.42	6023.61	16235.23	42717.69	431.55	4105.68
NOx (tons)	138.46	778.02	211.08	568.92	1496.92	15.12	143.87
HC + NOx (tons)	259.32	1457.19	395.34	1065.55	2803.65	28.32	269.46

TABLE A-5 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT

	Pumps	Air Compressors	Welders	Pressure Washers	Aerial Lifts	Forklifts	Forklifts
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	LPG
Activity Data							
Population	2749	2022	4955	132	2021	5010	14676
Average hp	67	65	60	29	49	73	73
Use Hours	221	484	208	115	361	1800	1800
Load Factor	0.69	0.56	0.51	0.85	0.46	0.30	0.30
Useful Life	13	13	13	13	9	10	10
Load-weighted Annual Usage (hp-hr)	10206	17697	6370	2835	8209	39242	39243
Emission Inventory							
HC (tons/day)	0.53	0.67	0.59	0.01	0.31	3.69	2.92
CO (tons/day)	17.24	21.98	19.39	0.23	10.19	120.78	49.10
NOx (tons/day)	0.60	0.77	0.68	0.01	0.36	4.23	20.85
HC + NOx (tons/day)	1.13	1.44	1.27	0.02	0.67	7.92	23.77
Equipment Lifetime Emissions, per engine							
HC (tons)	0.94	1.57	0.57	0.25	0.50	2.62	0.71
CO (tons)	30.66	51.38	18.76	8.26	16.51	85.52	11.87
NOx (tons)	1.07	1.80	0.66	0.29	0.58	3.00	5.04
HC + NOx (tons)	2.01	3.37	1.23	0.54	1.08	5.61	5.75
Equipment Lifetime Emissions for group							
HC (tons)	2578.06	3178.11	2842.92	33.37	1020.48	13106.67	10365.37
CO (tons)	84278.12	103893.98	92936.73	1090.79	33360.08	428464.26	174175.23
NOx (tons)	2953.29	3640.67	3256.70	38.22	1169.01	15014.30	73967.84
HC + NOx (tons)	5531.34	6818.77	6099.63	71.59	2189.49	28120.98	84333.21

TABLE A-5 (CONT'D). 2010 UNCONTROLLED EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT

	ALL Preempted Equipment			Preempted Agricultural Equipment			Preempted Construction Equipment		
	LPG	Gasoline	Total	LPG	Gasoline	Total	LPG	Gasoline	Total
Activity Data									
Population	14676	38650	53326	0	15740	15740	14676	22910	37586
Average hp									
Use Hours									
Load Factor									
Useful Life									
Load-weighted Annual Usage (hp-hr)									
Emission Inventory									
	Sum								
HC (tons/day)	2.92	8.85	11.77	0.00	1.65	1.65	2.92	7.20	10.12
CO (tons/day)	49.10	289.21	338.31	0.00	53.85	53.85	49.10	235.36	284.46
NOx (tons/day)	20.85	10.13	30.99	0.00	1.89	1.89	20.85	8.25	29.10
HC + NOx (tons/day)	23.77	18.98	42.76	0.06	3.54	3.54	23.77	15.45	39.22
Equipment Lifetime Emissions, per engine									
HC (tons)									
CO (tons)									
NOx (tons)									
HC + NOx (tons)									
Equipment Lifetime Emissions for group									
	Population weighted average								
HC (tons)	0.71	0.95	0.88		0.57	0.57	0.71	1.22	1.02
CO (tons)	11.87	31.09	25.80		18.47	18.47	11.87	39.76	28.87
NOx (tons)	5.04	1.09	2.18		0.65	0.65	5.04	1.39	2.82
HC + NOx (tons)	5.75	2.04	3.06		1.21	1.21	5.75	2.61	3.83
Average per Engine Lifetime Emissions									
	Population weighted average								
HC (lb)	1413	1902	1767	0	1130	1130	1413	2433	2034
CO (lb)	23736	62180	51600	0	36942	36942	23736	79520	57738
NOx (lb)	10080	2179	4353	0	1295	1295	10080	2787	5634
HC + NOx (lb)	11493	4081	6121	0	2425	2425	11493	5219	7669

TABLE A-6. 2010 EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT WITH CONTROL TECHNOLOGY

Average Emission Factors (g/hp-hr)								
Reduction	90%	95%	77%					
	Controlled				Uncontrolled			
	HC	CO	NOx	HC+NOx	HC	CO	NOx	HC+NOx
Gasoline	0.62	10.17	1.64	2.26	6.22	203.43	7.13	13.35
LPG	0.17	1.41	2.76	2.93	1.68	28.23	11.99	13.67
	Forklifts	Gen. Sets	Baggage Tug	Belt Loader	Bobtail	Cargo Loader	Forklift	Lift
	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas	Comp. Gas
Activity Data								
Population	4034	393	126	27	3	7	289	8
Average hp	41	112	100	60	100	70	50	100
Use Hours	1800	115	876	810	6	8	6	376
Load Factor	0.3	0.68	0.55	0.5	0.55	0.5	0.3	0.5
Useful Life	3	16	6	7	6	8	6	16
Load-weighted Annual Usage (hp-hr)	22140	8722	48180	24300	330	280	90	18800
Emission Inventory								
HC (tons/day)	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO (tons/day)	0.38	0.01	0.03	0.00	0.00	0.00	0.00	0.00
NOx (tons/day)	0.74	0.03	0.05	0.01	0.00	0.00	0.00	0.00
HC + NOx (tons/day)	0.79	0.03	0.05	0.01	0.00	0.00	0.00	0.00
Lifetime Emissions, per engine								
HC (tons)	0.01	0.03	0.05	0.03	0.00	0.00	0.00	0.06
CO (tons)	0.10	0.22	0.45	0.26	0.00	0.00	0.00	0.47
NOx (tons)	0.20	0.42	0.88	0.52	0.01	0.01	0.00	0.91
HC + NOx (tons)	0.21	0.45	0.93	0.55	0.01	0.01	0.00	0.97
Lifetime Emissions for group								
HC (tons)	49.62	10.16	6.75	0.85	0.00	0.00	0.03	0.45
CO (tons)	416.88	85.33	56.67	7.15	0.01	0.02	0.24	3.74
NOx (tons)	814.38	166.69	110.71	13.96	0.02	0.05	0.47	7.31
HC + NOx (tons)	864.00	176.85	117.45	14.81	0.02	0.05	0.50	7.76

TABLE A-6 (CONT'D). 2010 EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT WITH CONTROL TECHNOLOGY

	Other	Forklifts	Sweeper/ Scrubber	Other Gn. Industrial	Other Mat. Handling	Gen. Sets	A/C Tug	Baggage Tug
	Comp. Gas	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data								
Population	25	1376	1672	423	199	18079	61	912
Average hp	50	41	50	45	54	42	130	100
Use Hours	16	1800	516	713	386	115	551	876
Load Factor	0.5	0.3	0.71	0.54	0.53	0.68	0.8	0.55
Useful Life	16	3	9	4	16	16	7	6
Load-weighted Annual Usage (hp-hr)	400	22140	18403	17411	10994	3272	57304	48180
Emission Inventory								
HC (tons/day)	0.00	0.06	0.06	0.01	0.00	0.11	0.01	0.08
CO (tons/day)	0.00	0.94	0.95	0.23	0.07	1.82	0.11	1.35
NOx (tons/day)	0.00	0.15	0.15	0.04	0.01	0.29	0.02	0.22
HC + NOx (tons/day)	0.00	0.21	0.21	0.05	0.01	0.40	0.03	0.30
Lifetime Emissions, per engine								
HC (tons)	0.00	0.05	0.11	0.05	0.12	0.04	0.28	0.20
CO (tons)	0.01	0.74	1.84	0.78	1.95	0.59	4.50	3.24
NOx (tons)	0.02	0.12	0.30	0.13	0.31	0.09	0.72	0.52
HC + NOx (tons)	0.02	0.17	0.41	0.17	0.43	0.13	1.00	0.72
Lifetime Emissions for group								
HC (tons)	0.03	62.69	187.77	20.09	23.71	649.28	16.78	180.84
CO (tons)	0.25	1024.70	3069.16	328.34	387.54	10612.68	274.34	2955.91
NOx (tons)	0.49	165.18	494.73	52.93	62.47	1710.70	44.22	476.48
HC + NOx (tons)	0.52	227.87	682.50	73.01	86.18	2359.98	61.01	657.32

TABLE A-6 (CONT'D). 2010 EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT WITH CONTROL TECHNOLOGY

	Belt Loader	Bobtail	Cargo Loader	Deicer	Forklift	Gr. Power Unit	Lift	Other
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data								
Population	430	130	131	40	124	101	198	226
Average hp	60	100	70	93	50	150	100	50
Use Hours	810	876	719	22	726	796	376	183
Load Factor	0.5	0.55	0.5	0.95	0.3	0.75	0.5	0.5
Useful Life	7	6	8	16	6	5	16	16
Load-weighted Annual Usage (hp-hr)	24300	48180	25165	1944	10890	89550	18800	4575
Emission Inventory								
HC (tons/day)	0.02	0.01	0.01	0.00	0.00	0.02	0.01	0.00
CO (tons/day)	0.32	0.19	0.10	0.00	0.04	0.28	0.11	0.03
NOx (tons/day)	0.05	0.03	0.02	0.00	0.01	0.04	0.02	0.01
HC + NOx (tons/day)	0.07	0.04	0.03	0.00	0.01	0.06	0.03	0.01
Lifetime Emissions, per engine								
HC (tons)	0.12	0.20	0.14	0.02	0.04	0.31	0.21	0.05
CO (tons)	1.91	3.24	2.26	0.35	0.73	5.02	3.37	0.82
NOx (tons)	0.31	0.52	0.36	0.06	0.12	0.81	0.54	0.13
HC + NOx (tons)	0.42	0.72	0.50	0.08	0.16	1.12	0.75	0.18
Lifetime Emissions for group								
HC (tons)	50.17	25.78	18.09	0.85	5.56	31.02	40.85	11.35
CO (tons)	820.07	421.35	295.69	13.95	90.84	507.03	667.76	185.48
NOx (tons)	132.19	67.92	47.66	2.25	14.64	81.73	107.64	29.90
HC + NOx (tons)	182.36	93.70	65.75	3.10	20.20	112.75	148.49	41.25

TABLE A-6 (CONT'D). 2010 EMISSION INVENTORY FOR NON-PREEMPTED 25-175HP LPG AND GASOLINE OFFROAD (INDUSTRIAL) EQUIPMENT WITH CONTROL TECHNOLOGY

	ALL Non-preempted M11 Equipment		
	Comp. Gas	Gasoline	Total
Activity Data			
Population	4912	24102	29014
Average hp			
Use Hours			
Load Factor			
Useful Life			
Load-weighted Annual Usage (hp-hr)			
Emission Inventory			
HC (tons/day)	0.05	0.40	0.45
CO (tons/day)	0.42	6.53	6.96
NOx (tons/day)	0.83	1.05	1.88
HC + NOx (tons/day)	0.88	1.45	2.33
Lifetime Emissions, per engine			
	Sum		
HC (tons)	0.18	1.92	2.10
CO (tons)	1.52	31.33	32.85
NOx (tons)	2.97	5.05	8.02
HC + NOx (tons)	3.15	6.97	10.12
Lifetime Emissions for group			
	Population weighted avg. per engine		
HC (tons)	0.01	0.05	
CO (tons)	0.12	0.90	
NOx (tons)	0.23	0.14	
HC + NOx (tons)	0.24	0.20	
Average per engine Lifetime Emissions			
	Population weighted avg. per engine		
HC (lb)	28	110	
CO (lb)	232	1797	
NOx (lb)	454	290	
HC + NOx (lb)	481	400	

TABLE A-7. 2010 EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT WITH CONTROL TECHNOLOGY

Average Emission Factors (g/hp-hr)								
Reduction	90%	95%	77%					
	Controlled				Uncontrolled			
	HC	CO	NOx	HC+NOx	HC	CO	NOx	HC+NOx
Gasoline	0.62	10.17	1.64	2.26	6.22	203.43	7.13	13.35
LPG	0.17	1.41	2.76	2.93	1.68	28.23	11.99	13.67
	Agr. Tractors	Combines	Balers	Sprayers	Swathers	Hydro Power Units	Oth. Agr.	Asphalt Pavers
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data								
Population	1075	369	5218	1990	6252	37	799	215
Average hp	87	125	49	65	106	41	68	42
Use Hours	550	125	68	80	95	450	124	392
Load Factor	0.62	0.74	0.55	0.50	0.52	0.56	0.55	0.66
Useful Life	16	9	16	14	14	5	15	9
Load-weighted Annual Usage (hp-hr)	29722	11546	1815	2619	5226	10339	4641	10931
Emission Inventory								
HC (tons/day)	0.06	0.01	0.02	0.01	0.06	0.00	0.01	0.00
CO (tons/day)	0.98	0.13	0.29	0.16	1.00	0.01	0.11	0.07
NOx (tons/day)	0.16	0.02	0.05	0.03	0.16	0.00	0.02	0.01
HC + NOx (tons/day)	0.22	0.03	0.07	0.04	0.22	0.00	0.03	0.01
Equipment Lifetime Emissions, per engine								
HC (tons)	0.33	0.07	0.02	0.02	0.05	0.03	0.05	0.07
CO (tons)	5.33	1.21	0.33	0.41	0.84	0.55	0.76	1.09
NOx (tons)	0.86	0.20	0.05	0.07	0.13	0.09	0.12	0.18
HC + NOx (tons)	1.19	0.27	0.07	0.09	0.19	0.12	0.17	0.24
Equipment Lifetime Emissions for group								
HC (tons)	350.66	27.35	103.94	49.33	319.69	1.26	37.13	14.33
CO (tons)	5731.64	447.00	1698.97	806.37	5225.37	20.52	606.97	234.21
NOx (tons)	923.91	72.05	273.86	129.98	842.30	3.31	97.84	37.75
HC + NOx (tons)	1274.57	99.40	377.81	179.32	1161.98	4.56	134.97	52.08

TABLE A-7 (CONT'D). 2010 EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT WITH CONTROL TECHNOLOGY

	Rollers	Paving Equip.	Trenchers	Bore/Drill Rigs	Concrete/Ind. Saws	Cranes	Crushing/Proc. Equip.
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data							
Population	279	472	1177	286	250	148	56
Average hp	62	43	39	86	46	63	96
Use Hours	621	175	402	107	610	415	241
Load Factor	0.62	0.59	0.66	0.79	0.78	0.47	0.85
Useful Life	16	12	8	16	3	13	16
Load-weighted Annual Usage (hp-hr)	23842	4429	10337	7283	21963	12295	19666
Emission Inventory							
HC (tons/day)	0.01	0.00	0.02	0.00	0.01	0.00	0.00
CO (tons/day)	0.20	0.06	0.37	0.06	0.17	0.06	0.03
NOx (tons/day)	0.03	0.01	0.06	0.01	0.03	0.01	0.01
HC + NOx (tons/day)	0.04	0.01	0.08	0.01	0.04	0.01	0.01
Equipment Lifetime Emissions, per engine							
HC (tons)	0.26	0.04	0.05	0.08	0.04	0.11	0.22
CO (tons)	4.28	0.60	0.90	1.31	0.65	1.76	3.53
NOx (tons)	0.69	0.10	0.14	0.21	0.10	0.28	0.57
HC + NOx (tons)	0.95	0.13	0.20	0.29	0.14	0.39	0.78
Equipment Lifetime Emissions for group							
HC (tons)	73.01	17.18	64.58	22.86	9.94	15.92	12.09
CO (tons)	1193.30	280.88	1055.63	373.64	162.52	260.26	197.56
NOx (tons)	192.35	45.28	170.16	60.23	26.20	41.95	31.85
HC + NOx (tons)	265.36	62.46	234.74	83.09	36.14	57.87	43.93

TABLE A-7 (CONT'D). 2010 EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT WITH CONTROL TECHNOLOGY

	Rough Terrain Forklifts	Rubber Tired Loaders	Tractors/Loaders/ Backhoes	Skid Steer Loaders	Dumpers/ Tenders	Other Const.	Pumps
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Activity Data							
Population	305	370	172	2120	35		2749
Average hp	84	68	63	50	66		67
Use Hours	413	512	870	310	127		221
Load Factor	0.63	0.54	0.48	0.58	0.41		0.69
Useful Life	15	4	16	10	16		13
Load-weighted Annual Usage (hp-hr)	21954	18759	26309	8986	3437		10206
Emission Inventory							
HC (tons/day)	0.01	0.01	0.01	0.04	0.00		0.05
CO (tons/day)	0.21	0.21	0.14	0.59	0.00		0.86
NOx (tons/day)	0.03	0.03	0.02	0.09	0.00		0.14
HC + NOx (tons/day)	0.04	0.04	0.03	0.13	0.00		0.19
Equipment Lifetime Emissions, per engine							
HC (tons)	0.22	0.05	0.29	0.06	0.04		0.09
CO (tons)	3.64	0.81	4.72	1.01	0.62		1.53
NOx (tons)	0.59	0.13	0.76	0.16	0.10		0.25
HC + NOx (tons)	0.81	0.18	1.05	0.22	0.14		0.34
Equipment Lifetime Emissions for group							
HC (tons)	67.92	18.43	49.66	130.67	1.32		257.81
CO (tons)	1110.12	301.18	811.76	2135.88	21.58		4213.91
NOx (tons)	178.94	48.55	130.85	344.29	3.48		679.26
HC + NOx (tons)	246.86	66.97	180.51	474.96	4.80		937.06

TABLE A-7 (CONT'D). 2010 EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT WITH CONTROL TECHNOLOGY

	Air Compressors	Welders	Pressure Washers	Aerial Lifts	Forklifts	Forklifts
	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	LPG
Activity Data						
Population	2022	4955	132	2021	5010	14676
Average hp	65	60	29	49	73	73
Use Hours	484	208	115	361	1800	1800
Load Factor	0.56	0.51	0.85	0.46	0.30	0.30
Useful Life	13	13	13	9	10	10
Load-weighted Annual Usage (hp-hr)	17697	6370	2835	8209	39242	39243
Emission Inventory						
HC (tons/day)	0.07	0.06	0.00	0.03	0.37	0.29
CO (tons/day)	1.10	0.97	0.01	0.51	6.04	2.46
NOx (tons/day)	0.18	0.16	0.00	0.08	0.97	4.80
HC + NOx (tons/day)	0.25	0.22	0.00	0.11	1.34	5.09
Equipment Lifetime Emissions, per engine						
HC (tons)	0.16	0.06	0.03	0.05	0.26	0.07
CO (tons)	2.57	0.94	0.41	0.83	4.28	0.59
NOx (tons)	0.41	0.15	0.07	0.13	0.69	1.16
HC + NOx (tons)	0.57	0.21	0.09	0.18	0.95	1.23
Equipment Lifetime Emissions for group						
HC (tons)	317.81	284.29	3.34	102.05	1310.67	1036.54
CO (tons)	5194.70	4646.84	54.54	1668.00	21423.21	8708.76
NOx (tons)	837.35	749.04	8.79	268.87	3453.29	17012.60
HC + NOx (tons)	1155.16	1033.33	12.13	370.92	4763.96	18049.14

TABLE A-7 (CONT'D). 2010 EMISSION INVENTORY FOR PREEMPTED 25-175HP OFFROAD LPG & GASOLINE EQUIPMENT WITH CONTROL TECHNOLOGY

	ALL Preempted M11 Equipment			Preempted Agricultural			Preempted Construction		
	LPG	Gasoline	Total	LPG	Gasoline	Total	LPG	Gasoline	Total
Activity Data									
Population	14676	38650	53326	0	15740	15740	14676	22910	37586
Average hp									
Use Hours									
Load Factor									
Useful Life									
Load-weighted Annual Usage (hp-hr)									
Emission Inventory									
HC (tons/day)	0.29	0.88	1.18	0.00	0.16	0.16	0.29	0.72	1.01
CO (tons/day)	2.46	14.46	16.92	0.00	2.69	2.69	2.46	11.77	14.22
NOx (tons/day)	4.80	2.33	7.13	0.00	0.43	0.43	4.80	1.90	6.69
HC + NOx (tons/day)	5.09	3.21	8.30	0.00	0.59	0.59	5.09	2.62	7.70
Equipment Lifetime Emissions, per engine									
HC (tons)	0.07	2.84	2.91	0.00	0.58	0.58	0.07	2.26	2.33
CO (tons)	0.59	46.39	46.98	0.00	9.42	9.42	0.59	36.96	37.56
NOx (tons)	1.16	7.48	8.64	0.00	1.52	1.52	1.16	5.96	7.12
HC + NOx (tons)	1.23	10.32	11.54	0.00	2.10	2.10	1.23	8.22	9.45
Equipment Lifetime Emissions for group									
	Population weighted average								
HC (tons)	0.07	0.10	0.09		0.06	0.06	0.07	0.12	0.10
CO (tons)	0.59	1.55	1.29		0.92	0.92	0.59	1.99	1.44
NOx (tons)	1.16	0.25	0.50		0.15	0.15	1.16	0.32	0.65
HC + NOx (tons)	1.23	0.35	0.59		0.21	0.21	1.23	0.44	0.75
	Population weighted average								
HC (lb)	141	190	177	0	113	113	141	243	203
CO (lb)	1187	3109	2580	0	1847	1847	1187	3976	2887
NOx (lb)	2318	501	1001	0	298	298	2318	641	1296
HC + NOx (lb)	2460	691	1178	0	411	411	2460	884	1499

APPENDIX B

ENGINE B BASELINE EMISSION RESULTS

- Chem 1B
- Chem 2B

ENGINE E BASELINE EMISSION RESULTS

- Chem 1E-C2
- Chem 2E-C2
- Chem 1E-D2
- Chem 2E-D2

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-201

ENGINE NUMBER B
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST CHEM1 B RUN
DATE 5/22/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	600.	2808.	23.	8.4	73.7	11.2	28.99	1.015	.994	.972	1.023
2	2100.	100.	110.	600.	2102.	110.	17.8	76.0	11.4	28.98	1.023	.991	.962	1.026
3	2100.	75.	82.	600.	2104.	82.	13.5	78.8	11.4	28.99	1.023	.991	.966	1.030
4	2100.	50.	55.	600.	2098.	56.	10.1	78.2	11.3	28.99	1.019	.993	.970	1.029
5	2100.	25.	27.	600.	2100.	28.	6.8	74.6	12.8	29.00	1.073	.973	.971	1.026
6	2100.	10.	11.	600.	2098.	12.	5.2	74.7	13.1	28.99	1.086	.969	.972	1.027
7	800.	0.	0.	600.	776.	0.	1.8	75.0	13.1	28.99	1.086	.969	.976	1.028

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	12.0	11.38	46.3	152.8	.00	11275.
2	43.0	46.87	776.9	450.5	.00	22770.
3	32.0	34.08	274.0	399.0	.00	17847.
4	22.0	18.15	33.4	320.4	.00	13616.
5	11.0	9.06	30.8	83.1	.00	9138.
6	4.0	3.13	36.0	13.8	.00	6932.
7	.0	5.40	30.3	.9	.00	2362.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.50	.68	2.78	9.17	.00	676.
2	.020	.9	.36	.94	15.54	9.01	.00	455.
3	.050	1.6	.68	1.70	13.70	19.95	.00	892.
4	.320	7.0	3.23	5.81	10.69	102.54	.00	4357.
5	.300	3.3	2.04	2.72	9.23	24.92	.00	2741.
6	.100	.4	.52	.31	3.60	1.38	.00	693.
7	.150	.0	.27	.81	4.55	.14	.00	354.
TOTAL		13.9	7.6	13.0	60.1	167.1	.0	10170.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.05	.20	.66	.000	49.
2	.07	1.12	.65	.000	33.
3	.12	.98	1.43	.000	64.
4	.42	.77	7.37	.000	313.
5	.20	.66	1.79	.000	197.
6	.02	.26	.10	.000	50.
7	.06	.33	.01	.000	25.

COMPOSITE RESULTS

BSHC ------- =	.93	G/HP-HR	=	1.25	G/KW-HR
BSCO ------- =	4.32	G/HP-HR	=	5.79	G/KW-HR
BSNOx ------ =	12.01	G/HP-HR	=	16.10	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	731.	G/HP-HR	=	980.	G/KW-HR
BSFC ------- =	.545	LB/HP-HR	=	.332	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-201

ENGINE NUMBER B	TEST CHEM1 B RUN	LPG LPG	
ENGINE MODEL	DATE 5/22/98 TIME	HCR 2.67	
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.817 H:.183 O:.000 X:.000	
ENGINE CYCLE OTTO	CELL 13 B BAG CART 1	ENGINE OIL	

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.2 (28.99)	98.1 (28.98)	98.2 (28.99)	98.2 (28.99)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/11.3	23.3 (74.0)/11.5	23.3 (74.0)/11.5	23.9 (75.0)/11.3
ENGINE AIR DEW PT., DEG. C (DEG. F)	15.2 (59.3)	15.5 (59.9)	15.5 (59.9)	15.3 (59.6)
ENGINE AIR TEMP, DEG. C (DEG. F)	23.2 (73.7)	24.4 (76.0)	26.0 (78.8)	25.7 (78.2)
ENGINE AIR: RH,% / AH,G/KG	61./ 11.2	57./ 11.4	52./ 11.4	53./ 11.3
NOx HUMIDITY C.F.	1.015	1.023	1.023	1.019
DRY-TO-WET C.F.	.972	.962	.966	.970
TIME SECONDS	600.0	600.1	600.0	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	11.74 (504.0)	11.77 (505.2)	11.81 (506.8)	11.88 (509.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	117.4 (5040.)	117.7 (5053.)	118.1 (5068.)	118.8 (5098.)
HC SAMPLE METER/RANGE/PPM	25.4/ 2/ 25.4	93.6/ 2/ 93.6	68.9/ 2/ 68.9	38.9/ 2/ 38.9
HC BCKGRD METER/RANGE/PPM	3.9/ 2/ 3.9	4.9/ 2/ 4.9	4.6/ 2/ 4.6	5.0/ 2/ 5.0
CO SAMPLE METER/RANGE/PPM	49.7/ 12/ 48.8	39.1/ 3/ 824.2	64.2/ 14/ 287.7	36.2/ 12/ 35.3
CO BCKGRD METER/RANGE/PPM	.6/ 12/ .6	.1/ 3/ 1.7	.2/ 14/ .8	.9/ 12/ .8
CO2 SAMPLE METER/RANGE/PCT	82.6/ 11/ .7653	76.6/ 3/ 1.5000	62.2/ 3/ 1.1832	91.7/ 11/ .9061
CO2 BCKGRD METER/RANGE/PCT	7.3/ 11/ .0489	3.3/ 3/ .0579	3.2/ 3/ .0562	7.6/ 11/ .0509
NOX SAMPLE METER/RANGE/PPM	92.3/ 2/ 92.3	27.0/ 4/ 270.8	23.7/ 4/ 237.7	76.5/ 3/ 191.2
NOX BCKGRD METER/RANGE/PPM	.4/ 2/ .4	.3/ 4/ 3.0	.1/ 4/ 1.0	.6/ 3/ 1.5
DILUTION FACTOR	15.05	7.32	9.55	12.73
HC CONCENTRATION PPM	21.76	89.36	64.77	34.29
CO CONCENTRATION PPM	46.46	777.40	273.28	33.14
CO2 CONCENTRATION PCT	.7197	1.4499	1.1329	.8593
NOX CONCENTRATION PPM	91.94	268.19	236.80	189.86
HC MASS GRAMS	1.897	7.813	5.680	3.025
CO MASS GRAMS	7.720	129.507	45.659	5.569
CO2 MASS GRAMS	1879.14	3795.70	2974.56	2269.39
NOX MASS GRAMS	25.463	75.098	66.496	53.408
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.634 (1.40)	1.344 (2.96)	1.024 (2.26)	.764 (1.68)
KW HR (HP HR)	1.49 (2.00)	5.35 (7.17)	3.98 (5.33)	2.73 (3.67)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	5039.8	5052.8	5067.6	5097.7
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-201

ENGINE NUMBER B
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST CHEM1 B RUN
DATE 5/22/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.2 (29.00)	98.2 (28.99)	98.1 (28.99)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/13.0	23.9 (75.0)/13.5	23.9 (75.0)/13.5
ENGINE AIR DEW PT., DEG. C (DEG. F)	17.3 (63.1)	17.7 (63.8)	17.7 (63.8)
ENGINE AIR TEMP, DEG. C (DEG. F)	23.7 (74.6)	23.7 (74.7)	23.9 (75.0)
ENGINE AIR: RH,% / AH,G/KG	67./ 12.8	69./ 13.1	68./ 13.1
NOx HUMIDITY C.F.	1.073	1.086	1.086
DRY-TO-WET C.F.	.971	.972	.976
TIME SECONDS	600.0	599.9	600.1
TOT. BLOWER RATE, SCMM (SCFM)*	11.88 (509.9)	12.00 (515.1)	11.95 (512.7)
90NM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	118.8 (5099.)	120.0 (5150.)	119.5 (5128.)
HC SAMPLE METER/RANGE/PPM	20.9/ 2/ 20.9	9.4/ 2/ 9.4	13.0/ 2/ 13.0
HC BCKGRD METER/RANGE/PPM	4.0/ 2/ 4.0	3.7/ 2/ 3.7	2.9/ 2/ 2.9
CO SAMPLE METER/RANGE/PPM	32.8/ 12/ 31.9	39.3/ 12/ 38.4	32.7/ 12/ 31.8
CO BCKGRD METER/RANGE/PPM	.3/ 12/ .3	2.0/ 12/ 1.9	1.2/ 12/ 1.1
CO2 SAMPLE METER/RANGE/PCT	72.0/ 11/ .6208	95.6/ 12/ .4800	79.8/ 13/ .1958
CO2 BCKGRD METER/RANGE/PCT	7.0/ 11/ .0468	11.3/ 12/ .0491	20.1/ 13/ .0484
NOX SAMPLE METER/RANGE/PPM	46.8/ 2/ 46.8	31.9/ 1/ 8.0	2.6/ 1/ .6
NOX BCKGRD METER/RANGE/PPM	.1/ 2/ .1	1.5/ 1/ .4	.6/ 1/ .1
DILUTION FACTOR	18.57	23.98	58.07
HC CONCENTRATION PPM	17.11	5.85	10.15
CO CONCENTRATION PPM	30.50	35.33	29.89
CO2 CONCENTRATION PCT	.5765	.4329	.1482
NOX CONCENTRATION PPM	46.71	7.61	.50
HC MASS GRAMS	1.510	.522	.901
CO MASS GRAMS	5.128	5.999	5.053
CO2 MASS GRAMS	1522.98	1155.08	393.71
NOX MASS GRAMS	13.847	2.306	.152
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.513 (1.13)	.390 (.86)	.135 (.30)
KW HR (HP HR)	1.37 (1.83)	.50 (.67)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	5099.3	5149.7	5128.0
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: CHEM 1B
FUEL: LPG HD5
ENGINE: B

PROJECT: 08-8778-202
TEST DATE: 05/22/98

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	5040	5053	5068	5098	5099	5150	5128	
Work, hp-hr	2	7.17	5.33	3.67	1.83	0.67	0	2.320
Dilution Factor	15.05	7.32	9.55	12.73	18.57	23.98	58.07	
HC Sample, ppm	25.4	93.6	68.9	38.9	20.9	9.4	13.0	
HC Background, ppm	3.9	4.9	4.6	5	4	3.7	2.9	
CH4 Sample, ppm	3.33	5.91	4.85	3.06	3.06	2.99	3.24	
CH4 Background, ppm	2.41	2.41	2.41	2.41	2.71	2.71	2.71	
NMHC Sample, ppm	21.6	86.8	63.3	35.4	17.4	6.0	9.3	
NMHC Background, ppm	1.1	2.1	1.8	2.2	0.9	0.6	-0.2	
THC Sample, ppm	24.9	92.7	68.2	38.4	20.4	9.0	12.5	
THC Background, ppm	3.5	4.5	4.2	4.6	3.6	3.3	2.5	
HC Concentration, ppm	21.8	89.4	64.8	34.3	17.1	5.9	10.1	
CH4 Concentration, ppm	1.1	3.8	2.7	0.8	0.5	0.4	0.6	
HMHC Concentration, ppm	20.5	85.0	61.7	33.3	16.5	5.4	9.5	
THC Mass, gram	1.90	7.81	5.68	3.03	1.51	0.52	0.90	2.16
CH4 Mass, gram	0.10	0.37	0.26	0.08	0.05	0.04	0.06	0.08
NMHC Mass, gram	1.79	7.43	5.41	2.94	1.46	0.48	0.84	2.08
THC, g/hp-hr	0.95	1.09	1.07	0.82	0.83	0.78		0.93
CH4, g/hp-hr	0.05	0.05	0.05	0.02	0.03	0.06		0.03
NMHC, g/hp-hr	0.89	1.04	1.01	0.80	0.80	0.72		0.90

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER B
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST -CHEM-2 B RUN
DATE 5/25/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	600.	2804.	23.	8.2	76.5	13.5	28.98	1.099	.965	.970	1.030
2	2100.	100.	110.	600.	2102.	110.	17.7	75.4	13.5	29.02	1.100	.964	.960	1.028
3	2100.	75.	83.	600.	2102.	83.	13.7	74.6	13.3	29.01	1.093	.967	.964	1.027
4	2100.	50.	55.	600.	2096.	56.	10.1	75.0	12.7	29.01	1.068	.975	.967	1.026
5	2100.	25.	28.	600.	2096.	27.	6.6	75.7	12.7	29.00	1.068	.975	.972	1.028
6	2100.	10.	11.	600.	2098.	11.	5.1	75.8	12.2	28.98	1.052	.980	.972	1.027
7	800.	0.	0.	600.	788.	0.	1.9	73.7	12.2	28.99	1.050	.981	.978	1.024

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	12.0	10.73	45.7	147.5	.00	11071.
2	43.0	49.78	849.3	482.8	.00	22582.
3	33.0	34.91	299.3	407.8	.00	18075.
4	22.0	18.45	32.9	331.5	.00	13593.
5	10.0	8.45	33.6	73.7	.00	8870.
6	4.0	3.03	46.8	11.5	.00	6811.
7	.0	4.86	29.9	1.1	.00	2490.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.49	.64	2.74	8.85	.00	664.
2	.020	.9	.35	1.00	16.99	9.66	.00	452.
3	.050	1.7	.69	1.75	14.96	20.39	.00	904.
4	.320	7.0	3.23	5.90	10.54	106.08	.00	4350.
5	.300	3.0	1.98	2.54	10.08	22.12	.00	2661.
6	.100	.4	.51	.30	4.68	1.15	.00	681.
7	.150	.0	.28	.73	4.48	.16	.00	374.
TOTAL		13.7	7.5	12.9	64.5	168.4	.0	10085.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.05	.20	.65	.000	49.
2	.07	1.24	.71	.000	33.
3	.13	1.09	1.49	.000	66.
4	.43	.77	7.76	.000	318.
5	.19	.74	1.62	.000	195.
6	.02	.34	.08	.000	50.
7	.05	.33	.01	.000	27.

COMPOSITE RESULTS

BSHC ------- =	.94	G/HP-HR	=	1.26	G/KW-HR
BSCO ------- =	4.72	G/HP-HR	=	6.32	G/KW-HR
BSNOx ------ =	12.32	G/HP-HR	=	16.52	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	738.	G/HP-HR	=	989.	G/KW-HR
BSFC ------- =	.551	LB/HP-HR	=	.335	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER B
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST CHEM-2 B RUN
DATE 5/25/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.1 (28.98)	98.2 (29.02)	98.2 (29.01)	98.2 (29.01)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/12.8	22.8 (73.0)/13.2	23.3 (74.0)/13.0	23.3 (74.0)/13.0
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.1 (64.5)	18.1 (64.6)	17.9 (64.2)	17.1 (62.8)
ENGINE AIR TEMP, DEG. C (DEG. F)	24.7 (76.5)	24.1 (75.4)	23.7 (74.6)	23.9 (75.0)
ENGINE AIR: RH,% / AH,G/KG	66./ 13.5	69./ 13.5	70./ 13.3	66./ 12.7
NOx HUMIDITY C.F.	1.099	1.100	1.093	1.068
DRY-TO-WET C.F.	.970	.960	.964	.967
TIME SECONDS	599.9	600.0	600.1	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	11.84 (508.2)	12.01 (515.5)	12.01 (515.5)	11.99 (514.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	118.4 (5081.)	120.1 (5155.)	120.1 (5155.)	119.9 (5148.)
HC SAMPLE METER/RANGE/PPM	23.8/ 2/ 23.8	97.0/ 2/ 97.0	69.0/ 2/ 69.0	38.3/ 2/ 38.3
HC BCKGRD METER/RANGE/PPM	3.7/ 2/ 3.7	4.6/ 2/ 4.6	4.2/ 2/ 4.2	4.1/ 2/ 4.1
CO SAMPLE METER/RANGE/PPM	49.1/ 12/ 48.2	41.4/ 3/ 883.8	68.3/ 14/ 309.2	35.3/ 12/ 34.4
CO BCKGRD METER/RANGE/PPM	1.0/ 12/ .9	.0/ 3/ .0	.1/ 14/ .4	.7/ 12/ .7
CO2 SAMPLE METER/RANGE/PCT	81.3/ 11/ .7464	74.6/ 3/ 1.4547	61.6/ 3/ 1.1705	91.1/ 11/ .8964
CO2 BCKGRD METER/RANGE/PCT	7.3/ 11/ .0489	3.0/ 3/ .0526	2.7/ 3/ .0474	7.6/ 11/ .0509
NOX SAMPLE METER/RANGE/PPM	81.7/ 2/ 81.7	26.2/ 4/ 262.8	22.3/ 4/ 223.7	74.5/ 3/ 186.2
NOX BCKGRD METER/RANGE/PPM	.5/ 2/ .5	.1/ 4/ 1.0	.1/ 4/ 1.0	.3/ 3/ .7
DILUTION FACTOR	15.43	7.51	9.63	12.87
HC CONCENTRATION PPM	20.34	93.00	65.23	34.51
CO CONCENTRATION PPM	45.44	832.79	293.47	32.33
CO2 CONCENTRATION PCT	.7008	1.4091	1.1280	.8494
NOX CONCENTRATION PPM	81.24	261.90	222.76	185.55
HC MASS GRAMS	1.788	8.296	5.819	3.074
CO MASS GRAMS	7.613	141.549	49.884	5.488
CO2 MASS GRAMS	1844.86	3763.61	3012.95	2265.44
NOX MASS GRAMS	24.576	80.474	67.984	55.251
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.622 (1.37)	1.340 (2.95)	1.039 (2.29)	.763 (1.68)
KW HR (HP HR)	1.49 (2.00)	5.34 (7.17)	4.10 (5.50)	2.73 (3.67)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	5081.4	5155.3	5155.5	5147.7
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER B	TEST -CHEM-2B RUN	LPG LPG
ENGINE MODEL	DATE 5/25/98 TIME	HCR 2.67
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 1	ENGINE OIL

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.2 (29.00)	98.1 (28.98)	98.2 (28.99)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	22.8 (73.0)/12.5	23.9 (75.0)/13.5	23.3 (74.0)/12.2
ENGINE AIR DEW PT., DEG. C (DEG. F)	17.1 (62.8)	16.6 (61.8)	16.5 (61.7)
ENGINE AIR TEMP, DEG. C (DEG. F)	24.3 (75.7)	24.3 (75.8)	23.2 (73.7)
ENGINE AIR: RH,% / AH,G/KG	64./ 12.7	62./ 12.2	66./ 12.2
NOx HUMIDITY C.F.	1.068	1.052	1.050
DRY-TO-WET C.F.	.972	.972	.978
TIME SECONDS	600.0	600.1	599.9
TOT. BLOWER RATE, SCMM (SCFM)*	12.01 (515.3)	12.00 (515.0)	12.00 (515.0)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	120.1 (5153.)	120.0 (5150.)	120.0 (5149.)
HC SAMPLE METER/RANGE/PPM	19.5/ 2/ 19.5	9.6/ 2/ 9.6	13.5/ 2/ 13.5
HC BCKGRD METER/RANGE/PPM	3.9/ 2/ 3.9	4.1/ 2/ 4.1	4.5/ 2/ 4.5
CO SAMPLE METER/RANGE/PPM	35.8/ 12/ 34.9	49.4/ 12/ 48.5	31.9/ 12/ 31.1
CO BCKGRD METER/RANGE/PPM	.8/ 12/ .8	1.0/ 12/ .9	1.0/ 12/ .9
CO2 SAMPLE METER/RANGE/PCT	70.3/ 11/ .5995	59.5/ 11/ .4749	47.9/ 12/ .2087
CO2 BCKGRD METER/RANGE/PCT	7.2/ 11/ .0482	7.7/ 11/ .0515	12.5/ 12/ .0541
NOX SAMPLE METER/RANGE/PPM	41.4/ 2/ 41.4	6.7/ 2/ 6.7	3.1/ 1/ .8
NOX BCKGRD METER/RANGE/PPM	.2/ 2/ .2	.2/ 2/ .2	.7/ 1/ .2
DILUTION FACTOR	19.22	24.19	54.55
HC CONCENTRATION PPM	15.80	5.67	9.08
CO CONCENTRATION PPM	32.95	45.96	29.33
CO2 CONCENTRATION PCT	.5538	.4255	.1556
NOX CONCENTRATION PPM	41.21	6.51	.60
HC MASS GRAMS	1.409	.505	.809
CO MASS GRAMS	5.598	7.804	4.980
CO2 MASS GRAMS	1478.41	1135.33	415.01
NOX MASS GRAMS	12.287	1.910	.177
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.498 (1.10)	.384 (.85)	.142 (.31)
KW HR (HP HR)	1.24 (1.67)	.50 (.67)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	5152.8	5150.4	5149.1
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: CHEM 2B
FUEL: LPG HD5
ENGINE: B

PROJECT: 08-8778-202
TEST DATE: 05/25/98

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	5081	5155	5155	5148	5153	5150	5149	
Work, hp-hr	2	7.17	5.5	3.67	1.67	0.67	0	2.281
Dilution Factor	15.43	7.51	9.63	12.87	19.22	24.19	54.55	
HC Sample, ppm	23.8	97.0	69.0	38.3	19.5	9.6	13.5	
HC Background, ppm	3.7	4.6	4.2	4.1	3.9	4.1	4.5	
CH4 Sample, ppm	3.25	6.15	4.8	3.35	3.19	3.21	3.26	
CH4 Background, ppm	2.58	2.85	2.85	2.85	2.85	2.85	2.85	
NMHC Sample, ppm	20.1	89.9	63.5	34.4	15.8	5.9	9.8	
NMHC Background, ppm	0.7	1.3	0.9	0.8	0.6	0.8	1.2	
THC Sample, ppm	23.3	96.1	68.3	37.8	19.0	9.1	13.0	
THC Background, ppm	3.3	4.2	3.8	3.7	3.5	3.7	4.1	
HC Concentration, ppm	20.3	93.0	65.2	34.5	15.8	5.7	9.1	
CH4 Concentration, ppm	0.8	3.7	2.2	0.7	0.5	0.5	0.5	
HMHC Concentration, ppm	19.4	88.8	62.7	33.7	15.2	5.1	8.6	
THC Mass, gram	1.79	8.30	5.82	3.07	1.41	0.51	0.81	2.14
CH4 Mass, gram	0.08	0.36	0.22	0.07	0.05	0.05	0.04	0.07
NMHC Mass, gram	1.70	7.92	5.59	3.00	1.36	0.46	0.76	2.07
THC, g/hp-hr	0.89	1.16	1.06	0.84	0.84	0.75		0.94
CH4, g/hp-hr	0.04	0.05	0.04	0.02	0.03	0.07		0.03
NMHC, g/hp-hr	0.85	1.10	1.02	0.82	0.81	0.68		0.91

Engine B
Chem 1B 5/22/98

Time	600	600.1	600	600	600	599.9	600.1	**Total**
bhp	0.7	0.9	1.6	7	3.3	0.4	0	**13.9**
Wgt. Factor	0.06	0.02	0.05	0.32	0.3	0.1	0.15	

	mg/hr							Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	mg/hp-hr
METHANE	616.76	2192.68	1546.09	486.98	284.51	226.17	332.55	33.95
ETHANE	259.77	1273.49	1036.75	424.39	215.36	79.01	243.67	24.30
ETHYLENE	4812.26	6473.30	5881.05	5146.13	3197.25	1265.98	1336.72	262.25
PROPANE	2159.71	24577.37	17148.40	6302.97	2189.33	414.42	2025.97	323.57
PROPYLENE	1314.35	2795.56	2473.10	1910.33	971.87	297.15	450.79	90.55
ACETYLENE	1180.56	2650.16	2164.03	856.71	884.48	550.88	518.42	65.06
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	3.28	63.00	110.94	125.86	7.11	2.42	10.22	3.68
TRANS-2-BUTENE	0.00	4.12	0.00	2.83	0.00	0.00	0.00	0.07
1-BUTENE	31.27	79.27	85.66	45.92	25.56	7.27	16.66	2.40
2-METHYLPROPENE (ISOBUTYLENE)	24.60	76.77	62.37	36.05	14.73	4.92	9.99	1.73
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	36.65	82.83	85.60	49.45	27.84	8.14	13.81	2.53
1,3-BUTADIENE	28.08	36.70	40.28	32.96	17.28	4.46	2.77	1.51
2-METHYLPROPANE (ISOBUTANE)	35.58	449.17	323.66	121.87	41.74	7.61	37.93	6.13
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	0.00	0.00	4.04	3.07	0.00	0.00	0.00	0.09
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	1.59	4.98	33.52	48.06	2.48	0.00	0.00	1.29
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1-BUTENE	0.00	4.40	6.74	4.09	0.00	0.00	0.00	0.12
PENTANE	11.70	12.80	22.62	29.05	3.71	5.01	5.18	0.99
UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1,3-BUTADIENE	4.15	29.14	44.67	94.51	0.58	0.00	0.00	2.41
TRANS-2-PENTENE	0.00	5.45	6.34	6.98	0.00	0.00	0.00	0.19
3,3-DIMETHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-PENTENE	0.00	7.77	7.19	8.15	0.00	0.00	0.00	0.22
2-METHYL-2-BUTENE	6.17	0.00	0.00	0.00	0.00	0.00	0.00	0.03
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLBUTANE	4.49	4.31	7.24	10.54	0.00	0.00	0.00	0.29
MTBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	8.82	4.94	8.48	11.17	0.00	0.00	0.00	0.33
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	5.99	26.37	8.34	17.47	0.00	0.00	0.00	0.50
2-METHYL-1-PENTENE	0.00	2.43	0.00	0.00	0.00	0.00	0.00	0.00
1-HEXENE	0.00	2.43	0.00	0.00	0.00	0.00	0.00	0.00
HEXANE	0.00	0.00	3.99	4.62	0.00	0.00	0.00	0.12
UNIDENTIFIED C6 OLEFINS	13.96	0.00	6.10	17.25	12.59	0.00	0.00	0.75
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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ETBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLPENTANE, NOTE A	0.00	0.00	1.82	2.83	0.00	0.00	0.00	0.07
METHYLCYCLOPENTANE, NOTE A	0.00	0.00	1.78	2.77	0.00	0.00	0.00	0.07
2,4-DIMETHYLPENTANE	0.30	0.93	6.78	6.39	0.00	0.00	0.00	0.17
2,2,3-TRIMETHYLBUTANE	0.00	3.98	0.00	0.00	0.00	0.00	0.00	0.01
3,4-DIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZENE	13.26	18.74	8.69	9.97	0.66	0.00	0.00	0.36
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	1.22	0.90	5.52	9.68	1.12	0.06	1.38	0.29
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEXANE	0.00	0.00	0.00	0.00	1.72	0.00	0.00	0.04
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	0.10	1.16	9.00	16.70	0.00	0.11	1.82	0.44
2-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLPENTANE	0.29	0.25	2.41	3.57	0.00	0.00	0.00	0.09
2,3,3-TRIMETHYLPENTANE	0.84	1.32	0.94	4.29	0.00	0.00	0.00	0.11
TOLUENE	5.96	5.90	5.01	3.60	0.28	0.00	12.49	0.28
2,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	42.83	5.50	0.00	0.96
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE, NOTE B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	9.75	10.22	7.40	6.78	6.61	0.00	0.00	0.38
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STYRENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
o-XYLENE	7.48	8.30	0.00	0.00	5.90	0.00	0.00	0.17
1-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n-PROPYLBENZENE	0.00	9.71	0.00	0.00	0.00	0.00	0.00	0.01
1-METHYL-3-ETHYLBENZENE	0.00	24.38	0.00	0.00	0.00	0.00	0.00	0.04
1-METHYL-4-ETHYLBENZENE	6.78	21.15	0.00	0.00	0.00	0.00	0.00	0.06
1,3,5-TRIMETHYLBENZENE	7.71	20.86	0.00	0.00	0.00	0.00	0.00	0.06
1-METHYL-2-ETHYLBENZENE	6.69	13.95	0.00	0.00	0.00	0.00	0.00	0.05
1,2,4-TRIMETHYLBENZENE	6.42	38.81	0.00	0.00	0.00	0.00	0.00	0.08
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DECANE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYLBENZENE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	0.00	15.20	0.00	0.00	0.00	0.00	0.00	0.02
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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INDAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	12.37	0.00	0.00	0.00	0.00	0.00	0.02
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.01
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-2-METHYLBENZENE	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	2.20	24.82	0.00	0.00	0.00	0.00	0.00	0.05
FORMALDEHYDE	1300.20	1595.13	1368.60	1987.80	999.00	316.85	373.14	86.46
ACETALDEHYDE	295.20	260.36	240.00	361.80	188.40	31.21	41.39	15.58
ACROLEIN	70.20	36.59	37.80	94.20	43.80	9.00	6.00	3.74
ACETONE	4.80	6.00	3.60	10.20	0.00	3.00	7.20	0.38
PROPIONALDEHYDE	0.00	10.80	14.40	212.40	0.00	0.00	0.00	4.96
CROTONALDEHYDE	0.00	3.60	4.80	2.40	11.40	0.00	6.60	0.39
ISOBUTYRALDEHYDE, NOTE H	6.60	1.20	1.80	0.00	0.00	2.40	0.00	0.05
METHYL ETHYL KETONE, NOTE H	6.60	1.20	1.80	0.00	0.00	2.40	0.00	0.05
BENZALDEHYDE	0.00	0.00	0.00	0.00	6.00	22.20	0.00	0.29
ISOVALERALDEHYDE	3.60	0.00	2.40	0.00	7.80	7.80	0.00	0.25
VALERALDEHYDE	0.00	0.00	7.80	0.00	0.00	0.00	9.00	0.13
O-TOLUALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M/P-TOLUALDEHYDE	9.00	3.00	9.00	16.20	0.00	0.00	0.00	0.45
HEXANALDEHYDE	9.60	13.80	4.80	6.00	11.40	0.00	30.00	0.79
DIMETHYLBENZALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	38.39	0.41
SUMMED SPECIATED VALUES	12334.57	43033.41	32863.37	18554.98	9223.32	3273.98	5532.07	942.86

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

Engine B
Chem 2B
5/25/98

	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Total hp
Time	599.9	600	600.1	600	600	600.1	599.9	
bhp	0.7	0.9	1.7	7	3	0.4	0	13.7
Wgt. Factor	0.06	0.02	0.05	0.32	0.3	0.1	0.15	

	mg/hr							Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	mg/hp-hr
METHANE	484.31	2153.60	1314.12	422.37	288.46	278.25	270.08	31.23
ETHANE	231.61	1304.40	1003.95	417.16	196.97	76.14	196.06	23.34
ETHYLENE	4355.09	6618.63	5470.34	4901.69	2617.44	1011.34	1122.48	240.18
PROPANE	1762.14	24955.63	16493.82	5869.63	1785.04	346.10	1588.38	300.45
PROPYLENE	1148.98	2827.74	2315.92	1818.22	785.42	221.19	367.85	82.92
ACETYLENE	1215.95	3009.49	2063.38	894.03	854.65	490.54	458.09	65.44
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	6.74	63.84	34.89	15.11	4.18	5.65	35.05	1.12
TRANS-2-BUTENE	0.00	8.86	4.07	0.00	0.00	0.00	0.00	0.03
1-BUTENE	28.26	105.59	78.94	48.18	23.50	5.68	11.61	2.37
2-METHYLPROPENE (ISOBUTYLENE)	20.66	105.98	58.29	35.82	16.10	5.55	10.17	1.80
2.2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	34.02	95.45	76.03	49.77	24.53	5.98	11.65	2.44
1.3-BUTADIENE	26.80	88.20	32.97	31.62	13.40	0.00	3.53	1.44
2-METHYLPROPANE (ISOBUTANE)	31.22	452.24	304.96	105.09	31.23	8.20	34.17	5.48
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	0.00	6.43	2.85	0.00	0.00	0.00	0.00	0.02
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	4.32	9.14	2.71	5.86	1.56	9.00	8.25	0.37
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	0.00	29.97	16.43	0.00	0.00	0.00	0.00	0.10
2-METHYL-1-BUTENE	0.00	8.75	4.54	0.00	0.00	0.00	0.00	0.03
PENTANE	6.24	13.47	11.28	11.40	8.10	9.97	9.54	0.71
UNIDENTIFIED C5 OLEFINS	0.00	4.61	0.00	0.00	0.00	0.00	0.00	0.01
2-METHYL-1.3-BUTADIENE	28.12	40.81	39.49	98.88	7.04	0.00	0.00	2.79
TRANS-2-PENTENE	0.00	7.39	0.00	0.00	0.00	0.00	0.00	0.01
3.3-DIMETHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-PENTENE	0.00	8.25	6.17	5.01	0.00	0.00	0.00	0.15
2-METHYL-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTENE	0.00	6.99	0.00	0.00	0.00	0.00	0.00	0.01
4-METHYL-1-PENTENE	0.00	8.88	0.00	0.00	0.00	0.00	0.00	0.01
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.3-DIMETHYLBUTANE	0.00	2.69	0.00	0.00	0.00	0.00	0.00	0.00
MTBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	0.00	6.71	1.47	0.00	0.00	4.37	0.00	0.05
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	0.00	9.44	0.00	10.05	4.31	0.00	0.00	0.34
2-METHYL-1-PENTENE	0.00	13.25	0.00	0.00	0.00	0.00	0.00	0.02
1-HEXENE	0.00	13.25	0.00	0.00	0.00	0.00	0.00	0.02
HEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C6 OLEFINS	27.08	12.59	5.29	24.69	19.86	0.00	0.00	1.17
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Chem 2B

ETBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLPENTANE, NOTE A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOPENTANE, NOTE A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLPENTANE	0.00	0.00	0.00	5.02	0.00	7.08	6.28	0.24
2,2,3-TRIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZENE	6.09	59.91	10.86	6.70	4.93	6.02	3.07	0.50
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.76	0.69	0.01
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	18.28	4.72	0.00	0.00	0.00	0.00	0.04
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	0.00	10.65	0.00	0.00	0.00	3.22	0.00	0.04
2-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	0.00	0.00	0.00	4.71	0.00	0.00	0.00	0.11
2-METHYL-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	3.93	0.04
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLPENTANE	0.00	0.40	0.00	0.06	0.46	0.60	0.00	0.02
2,3,3-TRIMETHYLPENTANE	2.88	1.20	0.00	0.32	1.27	1.69	2.49	0.09
TOLUENE	1.85	39.88	3.35	1.29	1.77	8.90	7.19	0.29
2,3-DIMETHYLHEXANE	0.00	6.62	0.00	0.00	0.00	0.00	0.00	0.01
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE, NOTE B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Chem ZB

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	0.00	4.58	0.00	0.00	0.00	0.00	0.00	0.01
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	0.00	12.48	6.12	4.59	0.00	0.00	0.00	0.15
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STYRENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
o-XYLENE	0.00	9.42	0.00	0.00	0.00	0.00	0.00	0.01
1-NONENE	0.00	6.22	0.00	0.00	0.00	0.00	0.00	0.01
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIMETHYLBENZENE	0.00	9.50	0.00	0.00	0.00	0.00	0.00	0.01
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DECANE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYLBENZENE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Chem ZB

INDAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	6.64	0.00	0.00	0.00	0.16
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORMALDEHYDE	1269.81	1319.40	1355.77	2064.60	868.80	305.35	352.86	85.78
ACETALDEHYDE	253.84	287.40	247.76	357.00	193.80	16.80	35.41	15.53
ACROLEIN	70.21	48.60	36.59	109.20	34.80	13.80	0.00	3.93
ACETONE	8.40	21.00	29.40	22.20	14.40	15.60	70.21	1.89
PROPIONALDEHYDE	0.00	15.00	14.40	5.40	0.00	0.00	0.00	0.20
CROTONALDEHYDE	13.80	8.40	35.39	8.40	9.00	7.20	0.00	0.65
ISOBUTYRALDEHYDE, NOTE H	0.00	12.60	14.40	23.40	18.60	24.00	21.60	1.44
METHYL ETHYL KETONE, NOTE H	0.00	12.60	14.40	23.40	18.60	24.00	21.60	1.44
BENZALDEHYDE	4.20	0.00	0.00	0.00	49.20	0.00	0.00	1.10
ISOVALERALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	7.80	0.09
VALERALDEHYDE	0.00	0.00	0.00	0.00	14.40	0.00	0.00	0.32
O-TOLUALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M/P-TOLUALDEHYDE	0.00	0.00	0.00	0.00	9.00	0.00	16.20	0.37
HEXANALDEHYDE	27.00	40.80	4.80	1.80	0.60	1.20	8.40	0.35
DIMETHYLBENZALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUMMED SPECIATED VALUES	11069.64	43937.20	31119.86	17409.31	7921.42	2914.14	4684.65	878.86

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

ENGINE E BASELINE EMISSION RESULTS

- **Chem 1E-C2**
- **Chem 2E-C2**
- **Chem 1E-D2**
- **Chem 2E-D2**

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST CHEM1 E RUN
DATE 5/29/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	F
1	2400.	25.	20.	300.	2398.	20.	16.7	79.0	13.5	29.10	1.099	.965	.977	1.030
2	1800.	100.	86.	600.	1804.	86.	24.7	78.0	13.1	29.10	1.084	.970	.977	1.028
3	1800.	75.	65.	600.	1798.	64.	17.6	78.0	12.8	29.09	1.075	.972	.976	1.028
4	1800.	50.	43.	600.	1806.	49.	15.6	83.0	12.5	29.08	1.064	.976	.976	1.034
5	1800.	25.	22.	600.	1806.	20.	12.3	80.0	12.1	29.08	1.049	.981	.979	1.029
6	1800.	10.	9.	600.	1804.	11.	11.3	83.0	13.5	29.01	1.101	.964	.980	1.038
7	1100.	0.	0.	600.	1138.	0.	5.8	81.0	12.7	28.99	1.068	.975	.982	1.035

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	9.2	161.28	7805.7	12.1	.00	10508.
2	29.4	187.18	11712.5	27.6	.00	15363.
3	21.8	115.40	6111.5	53.8	.00	14476.
4	17.3	109.27	6078.6	25.4	.00	11766.
5	6.7	159.00	6347.1	4.2	.00	6643.
6	3.6	235.94	5953.3	2.2	.00	5664.
7	.0	185.17	2899.1	.5	.00	2925.

WEIGHTED RESULTS

MODE	WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.6	1.00	9.68	468.34	.73	.00	630.
2	.020	.6	.49	3.74	234.25	.55	.00	307.
3	.050	1.1	.88	5.77	305.57	2.69	.00	724.
4	.320	5.5	4.98	34.97	1945.16	8.14	.00	3765.
5	.300	2.0	3.69	47.70	1904.13	1.27	.00	1993.
6	.100	.4	1.13	23.59	595.33	.22	.00	566.
7	.150	.0	.87	27.77	434.87	.08	.00	439.
TOTAL		10.1	13.0	153.2	5887.7	13.7	.0	8425.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.95	46.19	.07	.000	62.
2	.37	23.10	.05	.000	30.
3	.57	30.14	.27	.000	71.
4	3.45	*****	.80	.000	371.
5	4.70	*****	.12	.000	197.
6	2.33	58.72	.02	.000	56.
7	2.74	42.89	.01	.000	43.

COMPOSITE RESULTS

BSHC ------- =	15.11	G/HP-HR	= 20.27	G/KW-HR
BSCO ------- =	580.71	G/HP-HR	= 778.73	G/KW-HR
BSNOx ------ =	1.35	G/HP-HR	= 1.81	G/KW-HR
PARTICULATE =	.000	G/HP-HR	= .000	G/KW-HR
BSCO2 ------ =	831.	G/HP-HR	= 1114.	G/KW-HR
BSFC ------- =	1.287	LB/HP-HR	= .783	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST -CHEM1 E RUN
DATE 5/29/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.5 (29.10)	98.5 (29.10)	98.5 (29.09)	98.5 (29.08)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	25.6 (78.0)/12.7	25.0 (77.0)/12.2	28.3 (83.0)/13.1	28.3 (83.0)/13.1
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.1 (64.6)	17.7 (63.8)	17.4 (63.3)	17.0 (62.6)
ENGINE AIR TEMP, DEG. C (DEG. F)	26.1 (79.0)	25.6 (78.0)	25.6 (78.0)	28.3 (83.0)
ENGINE AIR: RH,% / AH,G/KG	61./ 13.5	62./ 13.1	61./ 12.8	50./ 12.5
NOx HUMIDITY C.F.	1.099	1.084	1.075	1.064
DRY-TO-WET C.F.	.977	.977	.976	.976
TIME SECONDS	300.1	599.9	599.9	599.9
TOT. BLOWER RATE, SCMM (SCFM)*	35.00 (1502.0)	34.97 (1500.8)	34.91 (1498.2)	34.90 (1497.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	175.0 (7513.)	349.6 (15006.)	349.0 (14979.)	348.9 (14976.)
HC SAMPLE METER/RANGE/PPM	11.1/ 3/ 110.8	12.9/ 3/ 128.7	81.9/ 2/ 81.9	78.0/ 2/ 78.0
HC BCKGRD METER/RANGE/PPM	.5/ 3/ 5.0	.6/ 3/ 6.0	6.1/ 2/ 6.1	6.2/ 2/ 6.2
CO SAMPLE METER/RANGE/PPM	93.6/ 2/ 2693.8	78.8/ 3/ 4053.3	57.5/ 3/ 2113.0	57.3/ 3/ 2099.6
CO BCKGRD METER/RANGE/PPM	.0/ 2/ .0	.0/ 3/ .0	.0/ 3/ .0	.0/ 3/ .0
CO2 SAMPLE METER/RANGE/PCT	27.8/ 11/ .2666	38.2/ 11/ .3691	36.5/ 11/ .3523	59.2/ 12/ .2938
CO2 BCKGRD METER/RANGE/PCT	4.6/ 11/ .0433	4.5/ 11/ .0424	4.6/ 11/ .0433	8.7/ 12/ .0428
NOX SAMPLE METER/RANGE/PPM	9.3/ 1/ 2.3	21.1/ 1/ 5.3	41.6/ 1/ 10.4	20.0/ 1/ 5.0
NOX BCKGRD METER/RANGE/PPM	.3/ 1/ .1	.3/ 1/ .1	.6/ 1/ .2	.4/ 1/ .1
DILUTION FACTOR	24.20	16.84	23.08	25.81
HC CONCENTRATION PPM	105.97	123.08	76.02	72.00
CO CONCENTRATION PPM	2627.04	3945.06	2062.15	2051.54
CO2 CONCENTRATION PCT	.2251	.3293	.3108	.2527
NOX CONCENTRATION PPM	2.26	5.21	10.28	4.91
HC MASS GRAMS	13.445	31.191	19.230	18.209
CO MASS GRAMS	650.695	1951.755	1018.411	1012.934
CO2 MASS GRAMS	875.97	2560.00	2412.29	1960.66
NOX MASS GRAMS	1.009	4.594	8.964	4.238
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.633 (1.39)	1.866 (4.11)	1.328 (2.93)	1.177 (2.59)
KW HR (HP HR)	.57 (.77)	3.65 (4.90)	2.71 (3.63)	2.15 (2.88)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	7512.6	15005.6	14979.0	14975.6
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E	TEST CHEM1 E RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 5/29/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 2 BAG CART 2	ENGINE OIL 20W50
	Baseline #2	

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.5 (29.08)	98.2 (29.01)	98.2 (28.99)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	27.8 (82.0)/11.8	27.8 (82.0)/11.8	28.3 (83.0)/10.8
ENGINE AIR DEW PT., DEG. C (DEG. F)	16.5 (61.7)	18.1 (64.6)	17.1 (62.8)
ENGINE AIR TEMP, DEG. C (DEG. F)	26.7 (80.0)	28.3 (83.0)	27.2 (81.0)
ENGINE AIR: RH,% / AH,G/KG	54./ 12.1	54./ 13.5	54./ 12.7
NOx HUMIDITY C.F.	1.049	1.101	1.068
DRY-TO-WET C.F.	.979	.980	.982
TIME SECONDS	599.8	600.0	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	34.85 (1495.5)	34.82 (1494.2)	34.67 (1488.0)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	348.3 (14950.)	348.2 (14942.)	346.7 (14880.)
HC SAMPLE METER/RANGE/PPM	11.0/ 3/ 109.8	16.2/ 3/ 161.6	12.8/ 3/ 127.7
HC BCKGRD METER/RANGE/PPM	.5/ 3/ 5.0	.6/ 3/ 6.0	.5/ 3/ 5.0
CO SAMPLE METER/RANGE/PPM	58.6/ 3/ 2188.0	56.6/ 3/ 2053.2	51.5/ 2/ 1001.0
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0	.0/ 3/ .0	.0/ 2/ .0
CO2 SAMPLE METER/RANGE/PCT	37.1/ 12/ .1829	66.1/ 13/ .1638	42.5/ 13/ .1052
CO2 BCKGRD METER/RANGE/PCT	8.4/ 12/ .0413	17.6/ 13/ .0432	17.4/ 13/ .0427
NOX SAMPLE METER/RANGE/PPM	3.5/ 1/ .9	2.4/ 1/ .6	1.2/ 1/ .3
NOX BCKGRD METER/RANGE/PPM	.2/ 1/ .1	.8/ 1/ .2	.8/ 1/ .2
DILUTION FACTOR	32.02	34.29	60.42
HC CONCENTRATION PPM	104.92	155.83	122.81
CO CONCENTRATION PPM	2145.45	2014.02	984.90
CO2 CONCENTRATION PCT	.1429	.1219	.0632
NOX CONCENTRATION PPM	.83	.41	.10
HC MASS GRAMS	26.490	39.323	30.861
CO MASS GRAMS	1057.500	992.212	483.185
CO2 MASS GRAMS	1106.86	944.03	487.42
NOX MASS GRAMS	.703	.362	.089
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.929 (2.05)	.856 (1.89)	.437 (.96)
KW HR (HP HR)	.84 (1.12)	.45 (.60)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	14950.1	14942.5	14879.9
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: CHEM 1E-C2 PROJECT: 08-8778-202
FUEL: CARB PHASE II TEST DATE: 05/29/98
ENGINE: E

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	7513	15006	14979	14976	14950	14942	14880	
Work, hp-hr	0.77	4.9	3.63	2.88	1.12	0.6	0	1.690
Dilution Factor	24.20	16.84	23.08	25.81	32.02	34.29	60.42	
HC Sample, ppm	110.8	128.7	81.9	78.0	109.8	161.6	127.7	
HC Background, ppm	5	6	6.1	6.2	5	6	5	
CH4 Sample, ppm	16.1	19.92	11.71	9.82	20.71	31.53	22.03	
CH4 Background, ppm	2.62	2.62	2.62	2.62	2.62	2.6	2.6	
NMHC Sample, ppm	91.6	104.9	67.9	66.3	85.1	123.9	101.4	
NMHC Background, ppm	1.9	2.9	3.0	3.1	1.9	2.9	1.9	
THC Sample, ppm	107.7	124.8	79.6	76.1	105.8	155.5	123.4	
THC Background, ppm	4.5	5.5	5.6	5.7	4.5	5.5	4.5	
HC Concentration, ppm	106.0	123.1	76.1	72.0	105.0	155.8	122.8	
CH4 Concentration, ppm	13.6	17.5	9.2	7.3	18.2	29.0	19.5	
HMHC Concentration, ppm	89.8	102.2	65.1	63.3	83.2	121.1	99.5	
HC Mass, gram	13.45	31.19	19.24	18.22	26.50	39.31	30.86	25.55
CH4 Mass, gram	1.93	4.95	2.60	2.06	5.13	8.18	5.47	4.30
NMHC Mass, gram	11.39	25.90	16.46	16.02	21.02	30.57	25.01	20.95
HC, g/hp-hr	17.47	6.37	5.30	6.33	23.66	65.52		15.12
CH4, g/hp-hr	2.50	1.01	0.72	0.72	4.58	13.64		2.54
NMHC, g/hp-hr	14.79	5.29	4.53	5.56	18.77	50.94		12.40

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST CHEM2 E RUN
DATE 6/ 2/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2400.	25.	19.	600.	2402.	19.	16.1	78.0	12.1	28.95	1.048	.982	.978	1.031
2	1800.	100.	86.	600.	1802.	86.	24.3	84.0	13.4	28.92	1.099	.965	.977	1.043
3	1800.	75.	64.	600.	1796.	65.	17.7	82.0	14.2	28.93	1.128	.956	.974	1.041
4	1800.	50.	43.	600.	1796.	44.	15.0	83.0	14.8	28.94	1.157	.948	.975	1.043
5	1800.	25.	21.	600.	1806.	24.	12.8	84.0	15.6	28.93	1.194	.938	.976	1.046
6	1800.	10.	9.	600.	1788.	10.	11.1	84.0	16.1	28.92	1.215	.933	.976	1.047
7	1100.	0.	0.	600.	1124.	0.	5.7	82.0	14.8	28.90	1.153	.949	.977	1.043

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	9.7	135.87	7341.0	13.0	.00	10463.
2	29.2	175.39	11640.2	29.0	.00	14926.
3	22.2	115.65	6120.3	58.6	.00	14620.
4	15.0	112.45	6245.4	18.0	.00	10640.
5	8.3	140.42	6376.2	6.6	.00	7300.
6	2.8	277.11	5743.1	1.8	.00	5544.
7	.1	171.89	2839.3	.6	.00	3008.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.6	.97	8.15	440.46	.78	.00	628.
2	.020	.6	.49	3.51	232.80	.58	.00	299.
3	.050	1.1	.88	5.78	306.02	2.93	.00	731.
4	.320	4.8	4.79	35.98	1998.52	5.76	.00	3405.
5	.300	2.5	3.83	42.13	1912.85	1.97	.00	2190.
6	.100	.3	1.11	27.71	574.31	.18	.00	554.
7	.150	.0	.86	25.78	425.90	.08	.00	451.
TOTAL		9.8	12.9	149.0	5890.9	12.3	.0	8258.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.83	44.77	.08	.000	64.
2	.36	23.66	.06	.000	30.
3	.59	31.11	.30	.000	74.
4	3.66	*****	.59	.000	346.
5	4.28	*****	.20	.000	223.
6	2.82	58.38	.02	.000	56.
7	2.62	43.29	.01	.000	46.

COMPOSITE RESULTS

BSHC ------- =	15.15	G/HP-HR	= 20.32	G/KW-HR
BSCO ------- =	598.79	G/HP-HR	= 802.98	G/KW-HR
BSNOx ------ =	1.25	G/HP-HR	= 1.67	G/KW-HR
PARTICULATE =	.000	G/HP-HR	= .000	G/KW-HR
BSCO2 ------ =	839.	G/HP-HR	= 1126.	G/KW-HR
BSFC ------- =	1.313	LB/HP-HR	= .799	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST -CHEM2 E RUN
DATE 6/ 2/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.0 (28.95)	97.9 (28.92)	98.0 (28.93)	98.0 (28.94)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	26.7 (80.0)/12.3	28.9 (84.0)/12.2	27.8 (82.0)/14.3	28.3 (83.0)/14.0
ENGINE AIR DEW PT., DEG. C (DEG. F)	16.4 (61.5)	18.0 (64.4)	18.8 (65.9)	19.6 (67.2)
ENGINE AIR TEMP, DEG. C (DEG. F)	25.6 (78.0)	28.9 (84.0)	27.8 (82.0)	28.3 (83.0)
ENGINE AIR: RH,% / AH,G/KG	57./ 12.1	52./ 13.4	58./ 14.2	59./ 14.8
NOx HUMIDITY C.F.	1.048	1.099	1.128	1.157
DRY-TO-WET C.F.	.978	.977	.974	.975
TIME SECONDS	599.8	599.9	599.8	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	34.70 (1489.2)	34.74 (1490.9)	34.81 (1493.9)	34.76 (1491.7)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	346.9 (14887.)	347.3 (14907.)	348.0 (14934.)	347.6 (14917.)
HC SAMPLE METER/RANGE/PPM	9.6/ 3/ 95.8	12.2/ 3/ 121.7	81.7/ 2/ 81.7	80.5/ 2/ 80.5
HC BCKGRD METER/RANGE/PPM	.6/ 3/ 6.0	.6/ 3/ 6.0	5.5/ 2/ 5.5	6.3/ 2/ 6.3
CO SAMPLE METER/RANGE/PPM	63.5/ 3/ 2550.4	78.7/ 3/ 4041.3	57.7/ 3/ 2126.5	58.3/ 3/ 2167.3
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0	.2/ 3/ 3.9	.0/ 3/ .0	.0/ 3/ .0
CO2 SAMPLE METER/RANGE/PCT	53.9/ 12/ .2671	72.9/ 12/ .3632	71.6/ 12/ .3566	54.7/ 12/ .2711
CO2 BCKGRD METER/RANGE/PCT	8.7/ 12/ .0428	8.9/ 12/ .0437	8.9/ 12/ .0437	8.8/ 12/ .0433
NOX SAMPLE METER/RANGE/PPM	10.3/ 1/ 2.6	22.5/ 1/ 5.6	43.1/ 1/ 10.8	13.4/ 1/ 3.4
NOX BCKGRD METER/RANGE/PPM	.1/ 1/ .0	.8/ 1/ .2	.4/ 1/ .1	.6/ 1/ .2
DILUTION FACTOR	24.87	16.97	22.87	26.65
HC CONCENTRATION PPM	90.04	116.09	76.40	74.39
CO CONCENTRATION PPM	2491.91	3946.76	2070.95	2116.46
CO2 CONCENTRATION PCT	.2260	.3221	.3148	.2295
NOX CONCENTRATION PPM	2.56	5.45	10.70	3.21
HC MASS GRAMS	22.637	29.226	19.268	18.741
CO MASS GRAMS	1223.085	1939.716	1019.713	1040.897
CO2 MASS GRAMS	1743.20	2487.32	2435.80	1773.34
NOX MASS GRAMS	2.159	4.831	9.765	3.001
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	1.218 (2.69)	1.834 (4.04)	1.336 (2.95)	1.131 (2.49)
KW HR (HP HR)	1.21 (1.62)	3.62 (4.86)	2.76 (3.70)	1.86 (2.50)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	14886.9	14906.6	14934.5	14916.9
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E	TEST -CHEM2 E RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 6/ 2/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 2 BAG CART 2	ENGINE OIL 20W50
	Baseline #2	

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.0 (28.93)	97.9 (28.92)	97.9 (28.90)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	28.9 (84.0)/13.8	28.3 (83.0)/14.0	28.9 (84.0)/13.8
ENGINE AIR DEW PT., DEG. C (DEG. F)	20.4 (68.7)	20.8 (69.5)	19.4 (67.0)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.9 (84.0)	28.9 (84.0)	27.8 (82.0)
ENGINE AIR: RH,% / AH,G/KG	60./ 15.6	62./ 16.1	61./ 14.8
NOx HUMIDITY C.F.	1.194	1.215	1.153
DRY-TO-WET C.F.	.976	.976	.977
TIME SECONDS	599.8	599.9	599.8
TOT. BLOWER RATE, SCMM (SCFM)*	34.74 (1490.8)	34.87 (1496.6)	34.73 (1490.3)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	347.2 (14903.)	348.7 (14963.)	347.1 (14898.)
HC SAMPLE METER/RANGE/PPM	9.8/ 3/ 97.8	18.8/ 3/ 187.6	11.9/ 3/ 118.7
HC BCKGRD METER/RANGE/PPM	.5/ 3/ 5.0	.5/ 3/ 5.0	.5/ 3/ 5.0
CO SAMPLE METER/RANGE/PPM	58.9/ 3/ 2208.9	55.5/ 3/ 1982.0	50.8/ 2/ 982.0
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0	.0/ 3/ .0	.0/ 2/ .0
CO2 SAMPLE METER/RANGE/PCT	40.5/ 12/ .1998	64.9/ 13/ .1609	42.5/ 13/ .1052
CO2 BCKGRD METER/RANGE/PCT	8.9/ 12/ .0437	17.5/ 13/ .0429	16.7/ 13/ .0409
NOX SAMPLE METER/RANGE/PPM	5.2/ 1/ 1.3	1.6/ 1/ .4	.6/ 1/ .2
NOX BCKGRD METER/RANGE/PPM	.7/ 1/ .2	.4/ 1/ .1	.2/ 1/ .1
DILUTION FACTOR	30.71	35.00	61.29
HC CONCENTRATION PPM	92.96	182.74	113.83
CO CONCENTRATION PPM	2162.10	1939.88	963.07
CO2 CONCENTRATION PCT	.1575	.1192	.0649
NOX CONCENTRATION PPM	1.13	.30	.10
HC MASS GRAMS	23.395	46.177	28.640
CO MASS GRAMS	1062.340	957.023	473.060
CO2 MASS GRAMS	1216.28	923.81	501.15
NOX MASS GRAMS	1.091	.299	.094
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.964 (2.13)	.838 (1.85)	.435 (.96)
KW HR (HP HR)	1.03 (1.38)	.34 (.46)	.01 (.01)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	14902.9	14963.3	14898.4
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: CHEM 2E-C2
FUEL: CARB PHASE II
ENGINE: E

PROJECT: 08-8778-202
TEST DATE: 06/02/98

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	14887	14907	14934	14917	14903	14963	14898	
Work, hp-hr	1.62	4.86	3.7	2.5	1.38	0.46	0	1.639
Dilution Factor	24.87	16.97	22.87	26.65	30.71	35.00	61.29	
HC Sample, ppm	98.8	121.7	81.7	80.5	97.8	187.6	118.7	
HC Background, ppm	6	6	5.5	6.3	5	5	5	
CH4 Sample, ppm	14.84	18.08	10.78	10.73	15.67	37.76	22.85	
CH4 Background, ppm	2.49	2.49	2.88	2.88	2.88	2.88	2.88	
NMHC Sample, ppm	81.1	100.1	68.8	67.7	79.1	142.5	91.4	
NMHC Background, ppm	3.0	3.0	2.1	2.9	1.6	1.6	1.6	
THC Sample, ppm	95.9	118.2	79.6	78.4	94.7	180.2	114.2	
THC Background, ppm	5.5	5.5	4.9	5.7	4.4	4.4	4.4	
HC Concentration, ppm	93.0	116.1	76.4	74.4	93.0	182.7	113.8	
CH4 Concentration, ppm	12.5	15.7	8.0	8.0	12.9	35.0	20.0	
HMHC Concentration, ppm	78.2	97.2	66.8	64.9	77.6	141.0	89.9	
HC Mass, gram	23.39	29.22	19.28	18.75	23.40	46.18	28.63	24.89
CH4 Mass, gram	3.50	4.43	2.26	2.24	3.63	9.88	5.63	4.05
NMHC Mass, gram	19.65	24.49	16.86	16.36	19.52	35.62	22.61	20.56
HC, g/hp-hr	14.44	6.01	5.21	7.50	16.96	100.40		15.18
CH4, g/hp-hr	2.16	0.91	0.61	0.90	2.63	21.47		2.47
NMHC, g/hp-hr	12.13	5.04	4.56	6.54	14.15	77.45		12.54

5/29/98

Engine E

CHEM 1 E

Time	600	600.1	600	600	600	599.9	600.1	**Total hp**
bhp	0.6	0.6	1.1	5.5	2	0.4	0	**10.2**
Wgt. Factor	0.06	0.02	0.05	0.32	0.3	0.1	0.15	

Chem 1E - C2	mg/hr							Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	mg/hp-hr
METHANE	11581.26	29700.63	15632.31	12398.02	30816.65	49157.80	32866.00	2463.58
ETHANE	571.30	1113.25	979.39	789.50	984.66	1580.10	1451.09	100.90
ETHYLENE	6293.14	16004.02	10918.31	9278.45	12137.47	16187.95	12268.45	1109.12
PROPANE	44.01	156.13	85.17	56.97	87.01	148.94	55.46	7.60
PROPYLENE	3241.92	6847.63	5455.10	4530.31	4694.70	5825.70	4534.37	463.24
ACETYLENE	10890.79	19732.71	12443.05	11815.70	32384.30	67321.87	48284.63	2857.01
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	185.38	466.90	285.46	273.92	335.57	349.97	288.65	29.54
TRANS-2-BUTENE	179.47	423.45	306.66	273.14	307.22	346.73	241.81	27.95
1-BUTENE	186.36	536.81	415.87	358.63	385.29	467.02	360.80	36.66
2-METHYLPROPENE (ISOBUTYLENE)	2719.94	6805.10	4977.08	4381.88	4643.44	5468.13	3970.86	439.79
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	336.55	649.58	590.77	446.93	533.83	846.43	738.40	55.03
1,3-BUTADIENE	472.79	1338.04	1143.70	890.60	920.45	1141.83	870.52	90.02
2-METHYLPROPANE (ISOBUTANE)	257.79	126.22	67.68	61.10	73.42	76.91	63.95	7.87
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	142.30	335.75	240.85	222.67	236.12	283.14	195.89	22.26
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	2249.83	4342.69	2406.05	2274.79	2697.42	2757.49	2261.05	244.53
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	28.00	169.20	107.28	95.78	94.90	108.65	72.46	8.95
2-METHYL-1-BUTENE	86.22	419.90	254.02	240.99	275.70	275.13	257.49	24.73
PENTANE	291.93	690.32	348.07	339.43	357.52	449.45	360.74	35.65
UNIDENTIFIED C5 OLEFINS	8.85	0.00	0.00	10.91	0.00	13.02	0.00	0.52
2-METHYL-1,3-BUTADIENE	201.22	580.21	410.24	365.57	350.20	442.45	319.48	35.14
TRANS-2-PENTENE	21.87	224.40	129.38	117.01	131.42	305.02	115.52	13.43
3,3-DIMETHYL-1-BUTENE	8.85	54.66	32.79	13.09	0.00	53.76	54.36	2.06
CIS-2-PENTENE	15.69	161.11	115.28	94.56	108.15	133.80	108.94	10.03
2-METHYL-2-BUTENE	175.84	680.75	416.66	399.20	437.47	501.84	373.44	40.21
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	371.04	818.30	464.26	467.92	521.28	783.89	600.95	52.60
2,2-DIMETHYLBUTANE	0.00	197.70	113.90	118.01	135.53	2.48	0.00	8.66
CYCLOPENTENE	10.11	114.21	59.85	65.80	55.74	55.49	51.38	5.58
4-METHYL-1-PENTENE	0.00	65.48	35.92	39.53	47.09	41.63	34.08	3.84
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	20.93	47.51	26.69	30.13	31.91	33.49	28.48	2.98
2,3-DIMETHYLBUTANE	150.03	1012.13	534.03	548.87	631.34	669.81	516.17	55.43
MTBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	146.00	5313.42	2688.54	2979.71	3649.78	3699.54	2991.72	305.55
4-METHYL-TRANS-2-PENTENE	14.40	0.00	0.00	0.00	0.00	0.00	0.00	0.08
3-METHYLPENTANE	87.22	1083.25	582.64	609.02	701.97	734.22	541.68	60.41
2-METHYL-1-PENTENE	15.10	94.12	57.48	49.86	41.54	27.59	6.90	3.71
1-HEXENE	15.10	94.12	57.48	49.86	57.01	27.59	6.90	4.17
HEXANE	118.25	491.82	276.89	275.83	292.62	373.27	191.35	26.75
UNIDENTIFIED C6 OLEFINS	17.05	183.69	88.61	59.69	90.73	318.02	185.83	11.29
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	0.00	49.31	28.38	29.85	29.94	26.24	31.79	2.78
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	6.06	88.91	47.50	48.43	53.11	50.15	47.78	4.72
3-METHYL-TRANS-2-PENTENE	14.56	148.39	86.29	89.61	101.66	85.45	87.21	8.72
2-METHYL-2-PENTENE	15.44	114.21	67.02	67.37	78.24	66.32	63.52	6.64
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	0.00	44.35	23.18	25.04	23.89	30.77	24.37	2.35

Chem LE

ETBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	11.79	122.73	68.78	70.38	82.04	87.25	66.02	7.09
2.2-DIMETHYLPENTANE. NOTE A	73.01	392.70	223.86	224.76	251.45	332.61	217.38	23.20
METHYLCYCLOPENTANE. NOTE A	17.35	32.55	12.65	15.87	19.85	0.00	0.00	1.31
2.4-DIMETHYLPENTANE	195.79	1686.49	888.51	943.17	1114.47	1129.12	911.12	95.65
2.2.3-TRIMETHYLBUTANE	47.88	92.98	12.34	43.57	98.97	125.58	106.29	7.60
3.4-DIMETHYL-1-PENTENE	5.56	20.81	11.62	11.19	13.32	16.84	0.00	1.04
1-METHYLCYCLOPENTENE	7.12	133.72	64.02	81.37	105.82	94.40	87.99	8.50
BENZENE	4289.37	8800.82	5082.78	4754.90	5292.18	6427.98	4601.16	502.91
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.3-DIMETHYLPENTANE	0.00	90.63	54.38	58.43	74.92	59.13	52.75	5.84
CYCLOHEXANE	60.98	60.44	34.90	32.72	40.99	49.72	33.78	3.86
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.3-DIMETHYLPENTANE	171.50	3150.65	1642.08	1730.12	2109.83	2137.22	1710.68	177.68
1.1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	7.61	33.93	17.94	18.84	19.55	20.48	16.54	1.81
3-METHYLHEXANE	61.04	715.74	374.00	391.68	469.89	482.03	386.09	40.11
CIS-1.3-DIMETHYLCYCLOPENTANE	8.28	109.86	63.61	61.77	75.85	76.22	66.76	6.47
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1.2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1.3-DIMETHYLCYCLOPENTANE	0.00	75.50	29.78	29.67	39.74	71.20	59.54	3.97
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2.4-TRIMETHYLPENTANE	2867.98	6016.37	3028.87	3141.03	3870.32	4005.14	3040.30	339.87
2-METHYL-1-HEXENE	0.00	24.44	13.81	13.09	22.27	15.67	0.00	1.34
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	60.68	517.34	289.54	287.28	338.13	345.15	283.27	29.30
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	83.54	252.01	86.09	106.69	203.58	195.28	170.36	15.16
2-METHYL-2-HEXENE	0.00	78.09	38.07	41.25	52.46	50.33	46.72	4.36
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	0.00	62.64	36.24	32.18	38.46	39.54	32.22	3.30
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.4.4-TRIMETHYL-1-PENTENE	6.59	58.44	32.87	31.71	38.67	39.40	37.39	3.38
2.3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	14.70	57.68	30.64	32.68	34.45	36.46	31.41	3.21
METHYLCYCLOHEXANE	63.71	229.99	125.60	126.49	149.32	159.62	131.44	13.30
CIS-1.2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.1.3-TRIMETHYLCYCLOPENTANE	7.70	57.21	33.19	31.35	39.10	37.99	34.75	3.34
2.4.4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2.3-TRIMETHYLPENTANE	397.90	666.97	354.42	361.73	438.21	444.52	348.02	39.10
2.5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.4-DIMETHYLHEXANE	411.56	837.78	434.90	454.94	555.83	542.57	428.51	48.44
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	77.63	40.87	45.16	51.35	54.86	40.63	4.42
3.3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	18.41	15.78	0.00	19.43	16.35	0.00	0.85
2.3.4-TRIMETHYLPENTANE	452.72	1361.42	656.37	700.38	902.07	862.96	691.79	75.69
2.3.3-TRIMETHYLPENTANE	486.52	1030.75	479.14	524.68	667.77	625.66	556.68	57.65
TOLUENE	10843.97	11295.48	7262.17	6526.60	6669.96	7274.28	5589.97	675.99
2.3-DIMETHYLHEXANE	243.26	799.43	372.24	405.77	523.53	537.25	405.18	44.18
1.1.2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.4-DIMETHYLHEXANE. NOTE B	42.55	93.31	51.51	67.39	85.02	60.75	44.99	6.56
4-METHYLHEPTANE	61.78	400.06	226.29	252.79	314.16	274.43	189.51	24.91
3-METHYLHEPTANE	12.89	387.81	196.72	337.71	417.53	308.68	215.71	30.87
1-CIS.2-TRANS.3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1.3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1.4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	9.45	0.00	0.00	0.00	0.00	0.00	0.00	0.06
2.2.5-TRIMETHYLHEXANE	292.12	574.37	290.92	308.51	390.70	396.73	299.99	33.74

Chem E

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	11.75	46.29	26.12	49.65	64.57	35.79	27.71	4.50
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	84.85	49.94	0.00	0.00	0.00	50.88	1.16
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	9.95	40.21	16.34	19.14	27.15	27.32	21.94	2.21
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	6.37	17.29	0.00	0.00	14.36	26.00	10.60	0.90
1-OCTENE	0.00	0.00	0.00	0.00	0.00	67.98	0.00	0.67
TRANS-4-OCTENE	9.45	0.00	0.00	0.00	0.00	0.00	0.00	0.06
OCTANE	23.12	272.53	138.12	134.88	192.00	194.60	148.63	15.32
UNIDENTIFIED C8	0.00	169.75	65.49	137.41	157.48	128.41	81.82	12.06
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	35.12	85.72	43.07	45.76	60.96	55.75	44.16	5.01
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	28.43	15.36	17.15	20.66	18.96	14.89	1.68
2,4-DIMETHYLHEPTANE	7.85	60.56	29.32	31.24	40.25	44.25	27.88	3.32
4,4-DIMETHYLHEPTANE	0.00	18.08	11.96	13.89	16.16	16.32	0.00	1.17
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	27.46	0.00	0.00	0.00	16.45	0.00	0.22
2,6-DIMETHYLHEPTANE, NOTE D	12.57	81.01	24.69	60.78	79.01	55.32	42.19	5.75
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE, NOTE E	17.45	158.45	76.76	86.01	114.94	110.89	76.62	9.08
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	622.89	2768.52	1724.81	1632.56	1867.03	2041.27	1562.84	166.67
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	1594.81	9195.88	5995.84	5476.69	5994.01	6512.76	4919.39	541.11
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	0.00	333.95	200.82	207.05	254.84	259.64	196.21	21.06
3-METHYLOCTANE	9.88	176.34	103.78	106.86	136.15	135.73	104.78	11.14
STYRENE	423.92	972.50	698.76	589.43	605.36	790.91	603.42	60.75
o-XYLENE	599.86	3026.02	1925.74	1820.72	2079.49	2185.87	1652.66	182.92
1-NONENE	36.01	280.93	174.41	165.66	209.20	210.19	160.35	17.39
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	26.32	230.00	118.88	119.84	157.23	153.99	115.01	12.77
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	20.22	112.21	73.49	42.01	69.56	95.14	65.61	5.96
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	5.62	28.62	0.00	20.60	24.85	20.63	14.25	1.88
n-PROPYLBENZENE	236.07	448.48	227.56	238.11	294.53	294.51	193.04	25.24
1-METHYL-3-ETHYLBENZENE	1123.25	1884.49	1146.66	1099.67	1332.63	1395.00	1027.74	118.41
1-METHYL-4-ETHYLBENZENE	509.52	860.89	517.68	521.84	601.00	635.79	463.13	54.31
1,3,5-TRIMETHYLBENZENE	657.23	982.20	623.69	613.69	737.12	734.13	550.30	65.07
1-METHYL-2-ETHYLBENZENE	417.11	592.71	342.32	345.15	427.61	456.53	324.06	37.94
1,2,4-TRIMETHYLBENZENE	2382.03	3264.59	1856.78	1637.02	2047.82	2227.30	1453.16	184.31
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DECANE, NOTE F	11.58	23.23	12.27	19.54	12.61	28.20	0.00	1.43
ISOBUTYLBENZENE, NOTE F	10.92	21.91	11.61	14.21	11.89	26.60	0.00	1.22
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	325.80	431.50	233.60	241.75	331.09	324.44	218.66	27.63
1,2,3-TRIMETHYLBENZENE	14.36	0.00	0.00	0.00	0.00	0.00	0.00	0.08
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Chem IE

INDAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	238.91	555.90	355.84	303.75	343.50	510.26	338.01	33.85
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	26.71	103.28	45.63	38.72	56.68	74.67	0.00	4.20
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	28.59	49.97	0.00	12.98	0.00	29.18	0.00	0.96
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	79.19	51.56	100.51	45.69	103.36	153.13	0.00	7.03
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	87.40	0.00	0.00	0.00	0.00	0.00	0.17
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	27.02	165.74	88.32	100.93	136.67	140.57	0.00	9.48
TERT-1-BUT-2-METHYLBENZENE	0.00	46.16	0.00	0.00	0.00	0.00	0.00	0.09
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	121.73	79.83	0.00	58.52	142.26	0.00	3.75
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	515.42	2082.92	1196.02	900.85	1325.43	1499.99	706.63	105.32
FORMALDEHYDE	528.00	1988.07	1375.20	1129.80	1358.40	2135.16	1643.73	134.25
ACETALDEHYDE	58.20	239.96	150.60	106.80	133.20	212.44	135.58	12.90
ACROLEIN	7.20	42.59	57.60	37.80	28.20	55.21	35.99	3.49
ACETONE	15.60	187.17	146.40	123.00	132.00	739.92	349.74	21.31
PROPIONALDEHYDE	14.40	38.99	30.00	0.00	45.00	159.63	147.58	5.37
CROTONALDEHYDE	0.60	59.39	34.80	8.40	28.80	63.01	50.99	2.77
ISOBUTYRALDEHYDE, NOTE H	0.00	34.19	19.80	17.40	22.20	0.00	0.00	1.36
METHYL ETHYL KETONE, NOTE H	0.00	34.19	19.80	17.40	22.20	0.00	0.00	1.36
BENZALDEHYDE	165.00	306.55	210.60	153.60	161.40	220.24	143.98	16.45
ISOVALERALDEHYDE	3.00	0.00	4.20	0.00	9.00	0.00	0.00	0.30
VALERALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O-TOLUALDEHYDE	46.20	0.00	0.00	0.00	0.00	0.00	0.00	0.27
M/P-TOLUALDEHYDE	37.80	293.35	186.60	138.60	84.60	236.44	147.58	13.04
HEXANALDEHYDE	0.00	0.00	0.00	29.40	0.00	0.00	0.00	0.92
DIMETHYLBENZALDEHYDE	9.00	56.99	59.40	16.80	0.00	0.00	0.00	0.98
SUMMED SPECIATED VALUES	73471.32	175209.26	106324.29	96271.78	147198.17	214401.23	154331.16	13018.13

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

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Engine E

-Chem 2E

Time	599.8	599.9	599.8	600	599.8	599.9	599.8	**Total hp**
bhp	0.6	0.6	1.1	4.8	2.5	0.3	0	**9.9**
Wgt. Factor	0.06	0.02	0.05	0.32	0.3	0.1	0.15	

Chem 2E - C2	mg/hr							Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	mg/hp-hr
METHANE	21019.75	26606.97	13596.46	13452.99	21785.45	59330.94	33833.37	2456.75
ETHANE	1129.60	995.64	905.83	716.01	812.59	1759.95	1313.40	98.88
ETHYLENE	13080.62	14517.68	10274.95	8907.41	10180.16	18893.76	12366.38	1135.12
PROPANE	74.32	85.16	42.05	29.18	61.66	149.21	76.43	6.31
PROPYLENE	5983.65	6197.23	5149.13	4218.69	4120.07	6829.95	4644.00	475.36
ACETYLENE	18521.46	17805.20	11242.64	11740.81	21000.38	86107.10	47264.30	2806.77
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	271.14	414.52	244.17	249.29	262.56	456.84	323.71	29.25
TRANS-2-BUTENE	332.83	374.88	276.94	256.55	265.98	393.88	262.72	28.48
1-BUTENE	426.10	488.65	383.90	330.89	337.24	541.13	376.10	37.59
2-METHYLPROPENE (ISOBUTYLENE)	5572.91	6082.05	4650.32	4132.19	4105.53	6205.75	4155.13	453.16
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	11.00	0.00	0.00	0.00	0.00	0.00	0.02
PROPYNE	627.30	570.75	517.12	365.04	399.86	995.26	684.52	51.91
1,3-BUTADIENE	1149.16	1176.59	1034.89	776.41	772.22	1367.70	946.41	91.22
2-METHYLPROPANE (ISOBUTANE)	68.19	100.40	64.85	62.82	62.59	93.43	71.86	6.90
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	270.14	299.47	221.09	203.03	215.39	309.54	207.67	22.72
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	2394.40	3622.49	2229.19	2305.99	2406.25	3116.27	2384.47	248.15
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	71.32	151.19	90.61	98.22	97.84	106.10	66.36	9.41
2-METHYL-1-BUTENE	186.36	342.63	297.93	276.27	283.85	401.80	208.35	28.07
PENTANE	329.14	572.13	485.23	516.38	520.47	594.53	375.67	49.76
UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1,3-BUTADIENE	413.30	528.48	435.68	416.89	400.65	511.92	295.33	41.03
TRANS-2-PENTENE	109.05	199.53	131.74	157.84	154.45	184.19	117.35	15.15
3,3-DIMETHYL-1-BUTENE	21.21	57.15	34.68	19.05	24.87	80.23	0.00	2.60
CIS-2-PENTENE	87.88	137.41	111.14	142.81	127.95	149.30	113.84	13.10
2-METHYL-2-BUTENE	390.82	618.06	395.29	459.07	465.96	516.19	348.82	45.07
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	591.61	725.31	484.93	488.03	511.04	825.78	526.01	55.07
2,2-DIMETHYLBUTANE	115.75	185.20	128.22	133.92	142.15	44.76	32.80	11.31
CYCLOPENTENE	50.83	97.47	55.40	53.84	58.66	78.51	37.93	5.67
4-METHYL-1-PENTENE	38.89	58.94	37.83	41.29	42.78	43.53	33.72	4.13
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	27.35	39.95	26.62	26.19	25.84	29.61	25.40	2.69
2,3-DIMETHYLBUTANE	473.35	891.36	506.40	602.81	632.69	684.18	486.83	60.17
MTBE	1247.63	0.00	0.00	0.00	0.00	0.00	0.00	7.56
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	2142.32	4888.46	2614.81	3387.09	3675.76	3821.15	2845.90	338.65
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	521.34	964.96	551.13	672.30	704.85	759.30	564.14	67.20
2-METHYL-1-PENTENE	30.05	46.83	47.23	34.70	44.49	49.13	41.58	4.11
1-HEXENE	48.04	122.97	47.23	34.70	64.90	63.52	41.47	5.14
HEXANE	241.10	439.58	252.60	296.13	303.78	334.98	236.30	29.37
UNIDENTIFIED C6 OLEFINS	0.00	60.92	128.73	165.66	134.80	324.92	210.56	16.68
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	17.04	46.90	17.88	32.63	33.66	34.70	31.91	3.20
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	32.05	80.67	35.11	53.53	57.08	64.57	48.81	5.39
3-METHYL-TRANS-2-PENTENE	64.10	139.36	62.39	94.60	103.34	106.90	81.96	9.50
2-METHYL-2-PENTENE	50.81	105.45	49.76	72.15	77.79	79.79	59.78	7.17
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	18.79	39.81	18.32	25.32	23.35	36.41	24.35	2.55

Chem 2E

ETBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	34.13	83.50	63.26	77.33	82.27	87.10	59.70	7.47
2,2-DIMETHYLPENTANE, NOTE A	221.90	370.70	214.70	244.55	258.12	278.09	200.94	24.76
METHYLCYCLOPENTANE, NOTE A	21.25	36.26	10.19	15.06	17.53	13.67	2.39	1.45
2,4-DIMETHYLPENTANE	810.39	1504.80	837.51	1026.14	1118.53	1186.88	847.86	104.08
2,2,3-TRIMETHYLBUTANE	81.37	84.41	38.35	86.13	113.52	144.63	99.01	10.04
3,4-DIMETHYL-1-PENTENE	12.03	18.29	19.12	11.52	12.81	15.33	17.37	1.38
1-METHYLCYCLOPENTENE	86.66	115.77	86.72	91.39	104.23	92.17	33.51	8.75
BENZENE	6218.37	8282.31	5190.23	4740.36	5191.99	6830.76	4289.38	525.18
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	51.10	83.12	56.67	65.80	69.04	70.61	50.70	6.46
CYCLOHEXANE	35.88	41.84	25.72	33.87	34.26	42.87	32.87	3.50
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	1496.85	2830.22	1505.33	1909.74	2129.48	2183.62	1576.20	194.59
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	15.51	32.77	19.37	19.31	23.04	25.12	0.00	1.83
3-METHYLHEXANE	337.03	631.97	339.77	425.17	475.54	503.02	347.54	43.54
CIS-1,3-DIMETHYLCYCLOPENTANE	57.96	101.38	57.31	69.00	79.60	94.29	59.16	7.34
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	51.54	94.64	53.21	63.49	73.01	78.89	54.46	6.66
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	2669.84	5156.97	2708.58	3728.83	4035.11	3964.52	2798.92	365.54
2-METHYL-1-HEXENE	15.88	34.61	13.71	22.64	26.71	29.80	13.68	2.28
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	246.77	456.41	243.36	304.88	337.00	355.92	248.97	31.08
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	152.36	239.22	103.38	174.72	227.82	266.29	160.37	19.60
2-METHYL-2-HEXENE	33.77	73.33	39.43	50.56	57.23	58.03	45.59	5.20
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	30.22	57.71	31.77	38.14	44.56	43.93	29.82	3.94
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	27.95	52.97	27.68	37.92	43.00	44.29	32.06	3.88
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	27.52	54.66	27.86	34.81	43.44	39.93	26.20	3.66
METHYLCYCLOHEXANE	108.79	199.65	112.76	135.99	152.94	165.76	116.77	14.11
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	31.42	51.88	29.53	34.66	40.83	41.17	32.42	3.71
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	320.05	576.48	292.88	368.75	422.62	439.78	314.41	38.52
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	344.57	670.64	367.37	474.01	526.81	529.36	387.34	47.80
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	41.23	67.89	37.50	49.55	51.15	61.48	41.79	4.98
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	22.02	0.00	19.40	0.00	27.64	0.00	0.95
2,3,4-TRIMETHYLPENTANE	573.33	1197.47	579.73	790.11	917.78	884.14	652.04	80.98
2,3,3-TRIMETHYLPENTANE	475.68	900.50	475.58	587.72	667.16	655.49	534.72	61.04
TOLUENE	8113.85	10351.63	7288.06	6152.24	6452.12	8011.86	5515.48	665.77
2,3-DIMETHYLHEXANE	411.80	687.79	452.18	440.53	534.29	527.14	417.48	48.25
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE, NOTE B	62.19	110.84	45.76	82.01	93.53	67.15	50.33	7.76
4-METHYLHEPTANE	231.10	402.47	187.47	262.39	296.54	281.89	200.65	26.52
3-METHYLHEPTANE	283.44	536.02	189.23	367.76	431.56	281.80	206.83	34.70
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	266.96	503.56	262.92	344.87	395.60	388.27	277.37	35.22

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TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	22.65	42.13	23.58	60.74	35.58	33.61	28.48	4.15
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	45.86	77.34	63.58	0.00	69.24	0.00	56.23	3.71
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	18.53	38.96	19.87	23.63	27.70	29.58	40.45	2.81
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	20.99	17.63	14.38	12.38	0.00	26.41	1.37
1-OCTENE	0.00	0.00	0.00	0.00	0.00	57.41	0.00	0.58
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	117.40	231.62	140.56	174.31	195.80	183.20	153.52	17.63
UNIDENTIFIED C8	65.50	105.03	58.93	156.31	125.57	128.84	69.89	12.12
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	16.54	0.25
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	38.24	74.96	43.35	50.91	59.01	56.69	43.25	5.26
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	15.71	27.10	17.19	16.23	20.78	19.37	13.50	1.79
2,4-DIMETHYLHEPTANE	27.97	55.37	27.91	36.81	42.34	39.51	28.06	3.72
4,4-DIMETHYLHEPTANE	14.54	17.13	13.71	13.88	14.31	13.92	12.94	1.41
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE, NOTE D	42.05	74.03	53.93	70.31	58.71	34.16	44.20	5.74
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE, NOTE E	74.94	144.07	66.06	96.99	110.62	105.91	76.46	9.79
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	1610.99	2475.85	1571.30	1667.63	1866.74	2155.26	1476.70	177.32
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	5630.22	8261.82	5533.56	5533.42	6034.27	6941.06	4652.77	581.08
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	198.92	306.62	198.51	229.77	266.38	273.69	212.08	24.30
3-METHYLOCTANE	100.71	159.70	94.89	112.93	139.21	138.38	113.67	12.40
STYRENE	660.32	852.61	631.51	558.99	613.40	834.13	535.50	62.11
o-XYLENE	1854.53	2724.69	1791.85	1865.74	2087.14	2333.17	1595.20	197.08
1-NONENE	143.30	257.88	158.14	187.47	225.18	204.46	151.07	19.43
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	105.13	175.25	114.72	140.36	168.49	159.72	120.62	14.65
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	62.97	101.05	67.80	71.94	94.37	87.36	70.32	8.06
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	21.66	35.61	20.53	21.90	23.47	26.62	22.32	2.33
n-PROPYLBENZENE	217.68	381.29	208.91	349.66	296.88	298.00	190.84	29.34
1-METHYL-3-ETHYLBENZENE	1111.87	1635.12	1033.56	1145.91	1331.09	1490.67	983.52	122.60
1-METHYL-4-ETHYLBENZENE	496.89	769.93	491.32	514.47	596.63	669.76	451.62	55.37
1,3,5-TRIMETHYLBENZENE	642.29	868.07	579.22	632.72	711.68	787.04	534.21	66.63
1-METHYL-2-ETHYLBENZENE	341.54	518.53	327.89	347.10	415.51	470.33	315.29	38.11
1,2,4-TRIMETHYLBENZENE	1714.73	2687.26	1647.80	1655.13	2047.48	2310.34	1409.47	184.38
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DECANE, NOTE F	7.36	33.58	5.67	6.65	12.19	14.49	8.92	1.01
ISOBUTYLBENZENE, NOTE F	6.95	31.68	5.35	6.27	12.64	13.67	8.41	0.98
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	263.05	377.75	210.32	238.30	314.02	325.56	189.56	26.80
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Chem 2E

INDAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	340.06	480.76	309.81	282.22	352.92	532.29	276.72	33.9
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,4-DIETHYLBENZENE	35.94	88.39	39.36	44.85	54.25	68.02	0.00	4.3
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0.00	54.69	18.68	15.22	0.00	33.73	0.00	1.04
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	53.99	177.15	74.88	55.56	135.65	168.03	0.00	8.67
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	13.66	168.99	50.78	75.98	134.44	189.38	0.00	9.12
TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	114.86	0.00	0.00	74.73	115.96	0.00	3.67
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	790.65	1594.38	747.03	866.36	1293.27	1483.46	747.25	105.29
FORMALDEHYDE	1358.25	1816.50	1188.40	939.00	1084.56	2317.59	1501.70	127.28
ACETALDEHYDE	181.86	245.44	148.85	90.00	96.63	198.63	129.04	12.15
ACROLEIN	0.00	37.81	13.80	0.00	10.20	45.61	1.20	0.93
ACETONE	315.71	390.67	262.29	194.40	211.87	324.05	216.67	23.29
PROPIONALDEHYDE	101.43	153.63	42.61	64.20	68.42	158.43	100.83	8.42
CROTONALDEHYDE	58.22	70.81	39.61	52.20	51.62	90.02	59.42	5.76
ISOBUTYRALDEHYDE, NOTE H	0.00	44.41	25.81	0.00	7.20	0.00	0.00	0.44
METHYL ETHYL KETONE, NOTE H	0.00	44.41	25.81	0.00	7.20	0.00	0.00	0.44
BENZALDEHYDE	204.07	305.45	161.45	99.00	130.24	193.83	120.64	13.60
ISOVALERALDEHYDE	0.00	0.00	33.61	0.00	0.00	15.00	0.00	0.32
VALERALDEHYDE	0.00	0.00	0.00	26.40	31.81	34.81	28.21	2.60
O-TOLUALDEHYDE	61.82	55.81	27.61	57.00	30.01	0.00	0.00	3.38
M/P-TOLUALDEHYDE	53.42	304.85	26.41	30.00	45.02	120.02	6.00	4.71
HEXANALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIMETHYLBENZALDEHYDE	0.00	75.61	27.61	0.00	8.40	39.01	0.00	0.94
SUMMED SPECIATED VALUES	121485.97	157393.75	98418.16	98323.26	122938.94	251653.15	152379.68	13305.59

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST CHEM1 E RUN
DATE 5/29/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	1800.	100.	86.	600.	1804.	86.	24.7	78.0	13.1	29.10	1.084	.970	.977	1.028
2	1800.	75.	65.	600.	1798.	64.	17.6	78.0	12.8	29.09	1.075	.972	.976	1.028
3	1800.	50.	43.	600.	1806.	49.	15.6	83.0	12.5	29.08	1.064	.976	.976	1.034
4	1800.	25.	22.	600.	1806.	20.	12.3	80.0	12.1	29.08	1.049	.981	.979	1.029
5	1800.	10.	9.	600.	1804.	11.	11.3	83.0	13.5	29.01	1.101	.964	.980	1.038

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	29.4	187.18	11712.5	27.6	.00	15363.
2	21.8	115.40	6111.5	53.8	.00	14476.
3	17.3	109.27	6078.6	25.4	.00	11766.
4	6.7	159.00	6347.1	4.2	.00	6643.
5	3.6	235.94	5953.3	2.2	.00	5664.

WEIGHTED RESULTS

MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
.050	1.5	1.23	9.36	585.62	1.38	.00	768.
.250	5.4	4.39	28.85	1527.87	13.45	.00	3619.
.300	5.2	4.67	32.78	1823.59	7.63	.00	3530.
.300	2.0	3.69	47.70	1904.13	1.27	.00	1993.
.100	.4	1.13	23.59	595.33	.22	.00	566.
TOTAL	14.5	15.1	142.3	6436.5	23.9	.0	10476.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.65	40.45	.10	.000	53.
2	1.99	*****	.93	.000	250.
3	2.26	*****	.53	.000	244.
4	3.29	*****	.09	.000	138.
5	1.63	41.12	.02	.000	39.

COMPOSITE RESULTS

BSHC ------- =	9.83	G/HP-HR	= 13.18	G/KW-HR
BSCO ------- =	444.58	G/HP-HR	= 596.19	G/KW-HR
BSNOx ------ =	1.65	G/HP-HR	= 2.22	G/KW-HR
PARTICULATE =	.000	G/HP-HR	= .000	G/KW-HR
BSCO2 ------ =	724.	G/HP-HR	= 970.	G/KW-HR
BSFC ------- =	1.044	LB/HP-HR	= .635	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST -CHEM1 E RUN
DATE 5/29/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.5 (29.10)	98.5 (29.09)	98.5 (29.08)	98.5 (29.08)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	25.0 (77.0)/12.2	28.3 (83.0)/13.1	28.3 (83.0)/13.1	27.8 (82.0)/11.
ENGINE AIR DEW PT., DEG. C (DEG. F)	17.7 (63.8)	17.4 (63.3)	17.0 (62.6)	16.5 (61.7)
ENGINE AIR TEMP, DEG. C (DEG. F)	25.6 (78.0)	25.6 (78.0)	28.3 (83.0)	26.7 (80.0)
ENGINE AIR: RH,% / AH,G/KG	62./ 13.1	61./ 12.8	50./ 12.5	54./ 12.1
NOx HUMIDITY C.F.	1.084	1.075	1.064	1.049
DRY-TO-WET C.F.	.977	.976	.976	.979
TIME SECONDS	599.9	599.9	599.9	599.8
TOT. BLOWER RATE, SCMM (SCFM)*	39.61 (1500.8)	39.54 (1498.2)	39.53 (1497.8)	39.47 (1495.5)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	396.0 (15006.)	395.3 (14979.)	395.2 (14976.)	394.5 (14950.)
HC SAMPLE METER/RANGE/PPM	12.9/ 3/ 128.7	81.9/ 2/ 81.9	78.0/ 2/ 78.0	11.0/ 3/ 109.8
HC BCKGRD METER/RANGE/PPM	.6/ 3/ 6.0	6.1/ 2/ 6.1	6.2/ 2/ 6.2	.5/ 3/ 5.0
CO SAMPLE METER/RANGE/PPM	78.8/ 3/ 4053.3	57.5/ 3/ 2113.0	57.3/ 3/ 2099.6	58.6/ 3/ 2188.0
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0	.0/ 3/ .0	.0/ 3/ .0	.0/ 3/ .0
CO2 SAMPLE METER/RANGE/PCT	38.2/ 11/ .3691	36.5/ 11/ .3523	59.2/ 12/ .2938	37.1/ 12/ .1829
CO2 BCKGRD METER/RANGE/PCT	4.5/ 11/ .0424	4.6/ 11/ .0433	8.7/ 12/ .0428	8.4/ 12/ .0413
NOX SAMPLE METER/RANGE/PPM	21.1/ 1/ 5.3	41.6/ 1/ 10.4	20.0/ 1/ 5.0	3.5/ 1/ .9
NOX BCKGRD METER/RANGE/PPM	.3/ 1/ .1	.6/ 1/ .2	.4/ 1/ .1	.2/ 1/ .1
DILUTION FACTOR	16.84	23.08	25.81	32.02
HC CONCENTRATION PPM	123.08	76.02	72.00	104.92
CO CONCENTRATION PPM	3945.06	2062.15	2051.54	2145.45
CO2 CONCENTRATION PCT	.3293	.3108	.2527	.1429
NOX CONCENTRATION PPM	5.21	10.28	4.91	.83
HC MASS GRAMS	31.191	19.230	18.209	26.490
CO MASS GRAMS	1951.755	1018.411	1012.934	1057.500
CO2 MASS GRAMS	2560.0	2412.3	1960.7	1106.9
NOX MASS GRAMS	4.594	8.964	4.238	.703
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	1.866 (4.11)	1.328 (2.93)	1.177 (2.59)	.929 (2.05)
KW HR (HP HR)	3.65 (4.90)	2.71 (3.63)	2.15 (2.88)	.84 (1.12)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	15005.6	14979.0	14975.6	14950.1
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E	TEST -CHEM1 E RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 5/29/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 2 BAG CART 2	ENGINE OIL 20W50
	Baseline #2	

MODE NUMBER	5
BAROMETER, kPa (IN HG)	98.2 (29.01)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	27.8 (82.0)/11.8
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.1 (64.6)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.3 (83.0)
ENGINE AIR: RH,% / AH,G/KG	54./ 13.5
NOx HUMIDITY C.F.	1.101
DRY-TO-WET C.F.	.980
TIME SECONDS	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	39.43 (1494.2)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	394.3 (14942.)
HC SAMPLE METER/RANGE/PPM	16.2/ 3/ 161.6
HC BCKGRD METER/RANGE/PPM	.6/ 3/ 6.0
CO SAMPLE METER/RANGE/PPM	56.6/ 3/ 2053.2
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0
CO2 SAMPLE METER/RANGE/PCT	66.1/ 13/ .1638
CO2 BCKGRD METER/RANGE/PCT	17.6/ 13/ .0432
NOX SAMPLE METER/RANGE/PPM	2.4/ 1/ .6
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .2
DILUTION FACTOR	34.29
HC CONCENTRATION PPM	155.83
CO CONCENTRATION PPM	2014.02
CO2 CONCENTRATION PCT	.1219
NOX CONCENTRATION PPM	.41
HC MASS GRAMS	39.323
CO MASS GRAMS	992.212
CO2 MASS GRAMS	944.0
NOX MASS GRAMS	.362
PART MASS GRAMS	.000
FUEL KG (LB)	.856 (1.89)
KW HR (HP HR)	.45 (.60)
FILTER NUMBER	
WEIGHT GAIN (mg)	.000
SAMPLE MULTIPLIER	.000
BLOWER 1 SCF	14942.5
BLOWER 2 SCF	.0
GAS METER 1 SCF	.000
GAS METER 2 SCF	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: CHEM 1E-D2
FUEL: CARB PHASE II
ENGINE: E

PROJECT: 08-8778-202
TEST DATE: 05/29/98

Mode	1	2	3	4	5	WEIGHTED TOTAL
Modal Weight Factor	0.05	0.25	0.30	0.30	0.10	
Total Flow, std. cu. ft.	15006	14979	14976	14950	14942	
Work, hp-hr	4.9	3.63	2.88	1.12	0.6	2.413
Dilution Factor	16.84	23.08	25.81	32.02	34.29	
HC Sample, ppm	128.7	81.9	78.0	109.8	161.6	
HC Background, ppm	6	6.1	6.2	5	6	
CH4 Sample, ppm	19.92	11.71	9.82	20.71	31.53	
CH4 Background, ppm	2.62	2.62	2.62	2.62	2.6	
NMHC Sample, ppm	104.9	67.9	66.3	85.1	123.9	
NMHC Background, ppm	2.9	3.0	3.1	1.9	2.9	
THC Sample, ppm	124.8	79.6	76.1	105.8	155.5	
THC Background, ppm	5.5	5.6	5.7	4.5	5.5	
HC Concentration, ppm	123.1	76.1	72.0	105.0	155.8	
CH4 Concentration, ppm	17.5	9.2	7.3	18.2	29.0	
HMHC Concentration, ppm	102.2	65.1	63.3	83.2	121.1	
HC Mass, gram	31.19	19.24	18.22	26.50	39.31	23.72
CH4 Mass, gram	4.95	2.60	2.06	5.13	8.18	3.87
NMHC Mass, gram	25.90	16.46	16.02	21.02	30.57	19.58
HC, g/hp-hr	6.37	5.30	6.33	23.66	65.52	9.83
CH4, g/hp-hr	1.01	0.72	0.72	4.58	13.64	1.61
NMHC, g/hp-hr	5.29	4.53	5.56	18.77	50.94	8.11

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST -CHEM2 E RUN
DATE 6/ 2/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	1800.	100.	86.	600.	1802.	86.	24.3	84.0	13.4	28.92	1.099	.965	.977	1.043
2	1800.	75.	64.	600.	1796.	65.	17.7	82.0	14.2	28.93	1.128	.956	.974	1.041
3	1800.	50.	43.	600.	1796.	44.	15.0	83.0	14.8	28.94	1.157	.948	.975	1.043
4	1800.	25.	21.	600.	1806.	24.	12.8	84.0	15.6	28.93	1.194	.938	.976	1.046
5	1800.	10.	9.	600.	1788.	10.	11.1	84.0	16.1	28.92	1.215	.933	.976	1.047

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	29.2	175.39	11640.2	29.0	.00	14926.
2	22.2	115.65	6120.3	58.6	.00	14620.
3	15.0	112.45	6245.4	18.0	.00	10640.
4	8.3	140.42	6376.2	6.6	.00	7300.
5	2.8	277.11	5743.1	1.8	.00	5544.

WEIGHTED RESULTS

MODE	WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.050	1.5	1.21	8.77	582.01	1.45	.00	746.
2	.250	5.6	4.42	28.91	1530.08	14.65	.00	3655.
3	.300	4.5	4.49	33.73	1873.62	5.40	.00	3192.
4	.300	2.5	3.83	42.13	1912.85	1.97	.00	2190.
5	.100	.3	1.11	27.71	574.31	.18	.00	554.
TOTAL		14.3	15.1	141.3	6472.9	23.6	.0	10338.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.61	40.78	.10	.000	52.
2	2.03	*****	1.03	.000	256.
3	2.36	*****	.38	.000	224.
4	2.95	*****	.14	.000	153.
5	1.94	40.24	.01	.000	39.

COMPOSITE RESULTS

BSHC ------- = 9.90 G/HP-HR = 13.27 G/KW-HR
BSCO ------- = 453.57 G/HP-HR = 608.24 G/KW-HR
BSNOx ------ = 1.66 G/HP-HR = 2.22 G/KW-HR
PARTICULATE = .000 G/HP-HR = .000 G/KW-HR
BSCO2 ------ = 724. G/HP-HR = 971. G/KW-HR
BSFC ------- = 1.055 LB/HP-HR = .642 kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST -CHEM2 E RUN
DATE 6/ 2/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 2 BAG CART 2
Baseline #2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	97.9 (28.92)	98.0 (28.93)	98.0 (28.94)	98.0 (28.93)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	28.9 (84.0)/12.2	27.8 (82.0)/14.3	28.3 (83.0)/14.0	28.9 (84.0)/13.
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.0 (64.4)	18.8 (65.9)	19.6 (67.2)	20.4 (68.7)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.9 (84.0)	27.8 (82.0)	28.3 (83.0)	28.9 (84.0)
ENGINE AIR: RH,% / AH,G/KG	52./ 13.4	58./ 14.2	59./ 14.8	60./ 15.6
NOx HUMIDITY C.F.	1.099	1.128	1.157	1.194
DRY-TO-WET C.F.	.977	.974	.975	.976
TIME SECONDS	599.9	599.8	600.0	599.8
TOT. BLOWER RATE, SCMM (SCFM)*	39.34 (1490.9)	39.42 (1493.9)	39.37 (1491.7)	39.34 (1490.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	393.4 (14907.)	394.1 (14934.)	393.7 (14917.)	393.3 (14903.)
HC SAMPLE METER/RANGE/PPM	12.2/ 3/ 121.7	81.7/ 2/ 81.7	80.5/ 2/ 80.5	9.8/ 3/ 97.8
HC BCKGRD METER/RANGE/PPM	.6/ 3/ 6.0	5.5/ 2/ 5.5	6.3/ 2/ 6.3	.5/ 3/ 5.0
CO SAMPLE METER/RANGE/PPM	78.7/ 3/ 4041.3	57.7/ 3/ 2126.5	58.3/ 3/ 2167.3	58.9/ 3/ 2208.9
CO BCKGRD METER/RANGE/PPM	.2/ 3/ 3.9	.0/ 3/ .0	.0/ 3/ .0	.0/ 3/ .0
CO2 SAMPLE METER/RANGE/PCT	72.9/ 12/ .3632	71.6/ 12/ .3566	54.7/ 12/ .2711	40.5/ 12/ .1998
CO2 BCKGRD METER/RANGE/PCT	8.9/ 12/ .0437	8.9/ 12/ .0437	8.8/ 12/ .0433	8.9/ 12/ .0437
NOX SAMPLE METER/RANGE/PPM	22.5/ 1/ 5.6	43.1/ 1/ 10.8	13.4/ 1/ 3.4	5.2/ 1/ 1.3
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .2	.4/ 1/ .1	.6/ 1/ .2	.7/ 1/ .2
DILUTION FACTOR	16.97	22.87	26.65	30.71
HC CONCENTRATION PPM	116.09	76.40	74.39	92.96
CO CONCENTRATION PPM	3946.76	2070.95	2116.46	2162.10
CO2 CONCENTRATION PCT	.3221	.3148	.2295	.1575
NOX CONCENTRATION PPM	5.45	10.70	3.21	1.13
HC MASS GRAMS	29.226	19.268	18.741	23.395
CO MASS GRAMS	1939.716	1019.713	1040.897	1062.340
CO2 MASS GRAMS	2487.3	2435.8	1773.3	1216.3
NOX MASS GRAMS	4.831	9.765	3.001	1.091
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	1.834 (4.04)	1.336 (2.95)	1.131 (2.49)	.964 (2.13)
KW HR (HP HR)	3.62 (4.86)	2.76 (3.70)	1.86 (2.50)	1.03 (1.38)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	14906.6	14934.5	14916.9	14902.9
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E	TEST -CHEM2 E RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 6/ 2/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 2 BAG CART 2	ENGINE OIL 20W50
	Baseline #2	

MODE NUMBER	5
BAROMETER, kPa (IN HG)	97.9 (28.92)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	28.3 (83.0)/14.0
ENGINE AIR DEW PT., DEG. C (DEG. F)	20.8 (69.5)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.9 (84.0)
ENGINE AIR: RH,% / AH,G/KG	62./ 16.1
NOx HUMIDITY C.F.	1.215
DRY-TO-WET C.F.	.976
TIME SECONDS	599.9
TOT. BLOWER RATE, SCMM (SCFM)*	39.49 (1496.6)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	394.9 (14963.)
HC SAMPLE METER/RANGE/PPM	18.8/ 3/ 187.6
HC BCKGRD METER/RANGE/PPM	.5/ 3/ 5.0
CO SAMPLE METER/RANGE/PPM	55.5/ 3/ 1982.0
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0
CO2 SAMPLE METER/RANGE/PCT	64.9/ 13/ .1609
CO2 BCKGRD METER/RANGE/PCT	17.5/ 13/ .0429
NOX SAMPLE METER/RANGE/PPM	1.6/ 1/ .4
NOX BCKGRD METER/RANGE/PPM	.4/ 1/ .1
DILUTION FACTOR	35.00
HC CONCENTRATION PPM	182.74
CO CONCENTRATION PPM	1939.88
CO2 CONCENTRATION PCT	.1192
NOX CONCENTRATION PPM	.30
HC MASS GRAMS	46.177
CO MASS GRAMS	957.023
CO2 MASS GRAMS	923.8
NOX MASS GRAMS	.299
PART MASS GRAMS	.000
FUEL KG (LB)	.838 (1.85)
KW HR (HP HR)	.34 (.46)
FILTER NUMBER	
WEIGHT GAIN (mg)	.000
SAMPLE MULTIPLIER	.000
BLOWER 1 SCF	14963.3
BLOWER 2 SCF	.0
GAS METER 1 SCF	.000
GAS METER 2 SCF	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: CHEM 2E-D2
FUEL: CARB PHASE II
ENGINE: E

PROJECT: 08-8778-202
TEST DATE: 06/02/98

Mode	1	2	3	4	5	WEIGHTED TOTAL
Modal Weight Factor	0.05	0.25	0.30	0.30	0.10	
Total Flow, std. cu. ft.	14907	14934	14917	14903	14963	
Work, hp-hr	4.86	3.7	2.5	1.38	0.46	2.378
Dilution Factor	16.97	22.87	26.65	30.71	35.00	
HC Sample, ppm	121.7	81.7	80.5	97.8	187.6	
HC Background, ppm	6	5.5	6.3	5	5	
CH4 Sample, ppm	18.08	10.78	10.73	15.67	37.76	
CH4 Background, ppm	2.49	2.88	2.88	2.88	2.88	
NMHC Sample, ppm	100.1	68.8	67.7	79.1	142.5	
NMHC Background, ppm	3.0	2.1	2.9	1.6	1.6	
THC Sample, ppm	118.2	79.6	78.4	94.7	180.2	
THC Background, ppm	5.5	4.9	5.7	4.4	4.4	
HC Concentration, ppm	116.1	76.4	74.4	93.0	182.7	
CH4 Concentration, ppm	15.7	8.0	8.0	12.9	35.0	
HMHC Concentration, ppm	97.2	66.8	64.9	77.6	141.0	
HC Mass, gram	29.22	19.28	18.75	23.40	46.18	23.55
CH4 Mass, gram	4.43	2.26	2.24	3.63	9.88	3.53
NMHC Mass, gram	24.49	16.86	16.36	19.52	35.62	19.77
HC, g/hp-hr	6.01	5.21	7.50	16.96	100.40	9.90
CH4, g/hp-hr	0.91	0.61	0.90	2.63	21.47	1.49
NMHC, g/hp-hr	5.04	4.56	6.54	14.15	77.45	8.31

Time	600.1	600	600	600	599.9	**Total hp**
bhp	1.5	5.5	5.2	2.0	0.4	**14.48**
Wgt. Factor	0.05	0.25	0.3	0.3	0.1	

Test No.: CHEM1E D2 Cycle	mg/hr					Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	mg/hp-hr
METHANE	29700.63	15632.31	12398.02	30816.65	49157.80	1607.27
ETHANE	1113.25	979.39	789.50	984.66	1580.10	68.42
ETHYLENE	16004.02	10918.31	9278.45	12137.47	16187.95	799.26
PROPANE	156.13	85.17	56.97	87.01	148.94	6.02
PROPYLENE	6847.63	5455.10	4530.31	4694.70	5825.70	349.19
ACETYLENE	19732.71	12443.05	11815.70	32384.30	67321.87	1663.65
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	466.90	285.46	273.92	335.57	349.97	21.59
TRANS-2-BUTENE	423.45	306.66	273.14	307.22	346.73	21.18
1-BUTENE	536.81	415.87	358.63	385.29	467.02	27.67
2-METHYLPROPENE (ISOBUTYLENE)	6805.10	4977.08	4381.88	4643.44	5468.13	334.18
2.2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	649.58	590.77	446.93	533.83	846.43	38.61
1,3-BUTADIENE	1338.04	1143.70	890.60	920.45	1141.83	69.77
2-METHYLPROPANE (ISOBUTANE)	126.22	67.68	61.10	73.42	76.91	4.92
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	335.75	240.85	222.67	236.12	283.14	16.78
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	4342.69	2406.05	2274.79	2697.42	2757.49	178.60
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	169.20	107.28	95.78	94.90	108.65	7.14
2-METHYL-1-BUTENE	419.90	254.02	240.99	275.70	275.13	18.44
PENTANE	690.32	348.07	339.43	357.52	449.45	25.94
UNIDENTIFIED C5 OLEFINS	0.00	0.00	10.91	0.00	13.02	0.32
2-METHYL-1.3-BUTADIENE	580.21	410.24	365.57	350.20	442.45	26.97
TRANS-2-PENTENE	224.40	129.38	117.01	131.42	305.02	10.26
3,3-DIMETHYL-1-BUTENE	54.66	32.79	13.09	0.00	53.76	1.40
CIS-2-PENTENE	161.11	115.28	94.56	108.15	133.80	7.67
2-METHYL-2-BUTENE	680.75	416.66	399.20	437.47	501.84	30.34
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	818.30	464.26	467.92	521.28	783.89	36.75
2.2-DIMETHYLBUTANE	197.70	113.90	118.01	135.53	2.48	7.92
CYCLOPENTENE	114.21	59.85	65.80	55.74	55.49	4.33
4-METHYL-1-PENTENE	65.48	35.92	39.53	47.09	41.63	2.93
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	47.51	26.69	30.13	31.91	33.49	2.14
2,3-DIMETHYLBUTANE	1012.13	534.03	548.87	631.34	669.81	41.79
MTBE	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	5313.42	2688.54	2979.71	3649.78	3699.54	227.67
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	1083.25	582.64	609.02	701.97	734.22	46.03
2-METHYL-1-PENTENE	94.12	57.48	49.86	41.54	27.59	3.40
1-HEXENE	94.12	57.48	49.86	57.01	27.59	3.72
HEXANE	491.82	276.89	275.83	292.62	373.27	20.83
UNIDENTIFIED C6 OLEFINS	183.69	88.61	59.69	90.73	318.02	7.48
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	49.31	28.38	29.85	29.94	26.24	2.08
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	88.91	47.50	48.43	53.11	50.15	3.58
3-METHYL-TRANS-2-PENTENE	148.39	86.29	89.61	101.66	85.45	6.56
2-METHYL-2-PENTENE	114.21	67.02	67.37	78.24	66.32	5.03
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	44.35	23.18	25.04	23.89	30.77	1.78

ETBE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	122.73	68.78	70.38	82.04	87.25	5.37
2,2-DIMETHYLPENTANE, NOTE A	392.70	223.86	224.76	251.45	332.61	17.38
METHYLCYCLOPENTANE, NOTE A	32.55	12.65	15.87	19.85	0.00	1.07
2,4-DIMETHYLPENTANE	1683.49	888.51	943.17	1114.47	1129.12	71.59
2,2,3-TRIMETHYLBUTANE	92.98	12.34	43.57	98.97	125.58	4.35
3,4-DIMETHYL-1-PENTENE	20.81	11.62	11.19	13.32	16.84	0.90
1-METHYLCYCLOPENTENE	133.72	64.02	81.37	105.82	94.40	6.10
BENZENE	8800.82	5082.78	4754.90	5292.18	6427.98	370.69
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	90.63	54.38	58.43	74.92	59.13	4.42
CYCLOHEXANE	60.44	34.90	32.72	40.99	49.72	2.68
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	3150.65	1642.08	1730.12	2109.83	2137.22	133.55
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	33.93	17.94	18.84	19.55	20.48	1.36
3-METHYLHEXANE	715.74	374.00	391.68	469.89	482.03	30.11
CIS-1,3-DIMETHYLCYCLOPENTANE	109.86	63.61	61.77	75.85	76.22	4.86
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	75.50	29.78	29.67	39.74	71.20	2.70
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	6016.37	3028.87	3141.03	3870.32	4005.14	245.99
2-METHYL-1-HEXENE	24.44	13.81	13.09	22.27	15.67	1.16
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	517.34	289.54	287.28	338.13	345.15	22.13
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	252.01	86.09	106.69	203.58	195.28	10.13
2-METHYL-2-HEXENE	78.09	38.07	41.25	52.46	50.33	3.22
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	62.64	36.24	32.18	38.46	39.54	2.58
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	58.44	32.87	31.71	38.67	39.40	2.50
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	57.68	30.64	32.68	34.45	36.46	2.37
METHYLCYCLOHEXANE	229.99	125.60	126.49	149.32	159.62	9.78
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	57.21	33.19	31.35	39.10	37.99	2.49
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	666.97	354.42	361.73	438.21	444.52	28.07
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	837.78	434.90	454.94	555.83	542.57	35.09
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	77.63	40.87	45.16	51.35	54.86	3.35
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	18.41	15.78	0.00	19.43	16.35	0.85
2,3,4-TRIMETHYLPENTANE	1361.42	656.37	700.38	902.07	862.96	55.19
2,3,3-TRIMETHYLPENTANE	1030.75	479.14	524.68	667.77	625.66	40.86
TOLUENE	11295.48	7262.17	6526.60	6669.96	7274.28	488.03
2,3-DIMETHYLHEXANE	799.43	372.24	405.77	523.53	537.25	32.15
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE, NOTE B	93.31	51.51	67.39	85.02	60.75	4.79
4-METHYLHEPTANE	400.06	226.29	252.79	314.16	274.43	18.93
3-METHYLHEPTANE	387.81	196.72	337.71	417.53	308.68	22.51
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	574.37	290.92	308.51	390.70	396.73	24.23

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	46.29	26.12	49.65	64.57	35.79	3.22
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	84.85	49.94	0.00	0.00	0.00	1.16
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	40.21	16.34	19.14	27.15	27.32	1.57
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	17.29	0.00	0.00	14.36	26.00	0.54
1-OCTENE	0.00	0.00	0.00	0.00	67.98	0.47
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	272.53	138.12	134.88	192.00	194.60	11.44
UNIDENTIFIED C8	169.75	65.49	137.41	157.48	128.41	8.71
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE. NOTE C	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	85.72	43.07	45.76	60.96	55.75	3.64
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	28.43	15.36	17.15	20.66	18.96	1.28
2,4-DIMETHYLHEPTANE	60.56	29.32	31.24	40.25	44.25	2.50
4,4-DIMETHYLHEPTANE	18.08	11.96	13.89	16.16	16.32	1.00
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	27.46	0.00	0.00	0.00	16.45	0.21
2,6-DIMETHYLHEPTANE. NOTE D	81.01	24.69	60.78	79.01	55.32	3.98
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE. NOTE E	158.45	76.76	86.01	114.94	110.89	6.80
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE. NOTE E	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	2768.52	1724.81	1632.56	1867.03	2041.27	125.94
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	9195.88	5995.84	5476.69	5994.01	6512.76	417.90
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	333.95	200.82	207.05	254.84	259.64	15.98
3-METHYLOCTANE	176.34	103.78	106.86	136.15	135.73	8.37
STYRENE	972.50	698.76	589.43	605.36	790.91	45.64
o-XYLENE	3026.02	1925.74	1820.72	2079.49	2185.87	139.60
1-NONENE	280.93	174.41	165.66	209.20	210.19	13.20
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	230.00	118.88	119.84	157.23	153.99	9.65
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	112.21	73.49	42.01	69.56	95.14	4.62
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	28.62	0.00	20.60	24.85	20.63	1.18
n-PROPYLBENZENE	448.48	227.56	238.11	294.53	294.51	18.55
1-METHYL-3-ETHYLBENZENE	1884.49	1146.66	1099.67	1332.63	1395.00	86.33
1-METHYL-4-ETHYLBENZENE	860.89	517.68	521.84	601.00	635.79	39.56
1,3,5-TRIMETHYLBENZENE	982.20	623.69	613.69	737.12	734.13	47.22
1-METHYL-2-ETHYLBENZENE	592.71	342.32	345.15	427.61	456.53	27.12
1,2,4-TRIMETHYLBENZENE	3264.59	1856.78	1637.02	2047.82	2227.30	135.06
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00
DECANE. NOTE F	23.23	12.27	19.54	12.61	28.20	1.15
ISOBUTYLBENZENE. NOTE F	21.91	11.61	14.21	11.89	26.60	1.00
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	431.50	233.60	241.75	331.09	324.44	19.63
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00

INDAN	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	555.90	355.84	303.75	343.50	510.26	25.00
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	103.28	45.63	38.72	56.68	74.67	3.64
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE. NOTE G	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	49.97	0.00	12.98	0.00	29.18	0.64
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	51.56	100.51	45.69	103.36	153.13	6.06
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	87.40	0.00	0.00	0.00	0.00	0.30
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	165.74	88.32	100.93	136.67	140.57	7.99
TERT-1-BUT-2-METHYLBENZENE	46.16	0.00	0.00	0.00	0.00	0.16
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	121.73	79.83	0.00	58.52	142.26	3.99
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	2082.92	1196.02	900.85	1325.43	1499.99	84.33
FORMALDEHYDE	1988.07	1375.20	1129.80	1358.40	2135.16	96.90
ACETALDEHYDE	239.96	150.60	106.80	133.20	212.44	9.87
ACROLEIN	42.59	57.60	37.80	28.20	55.21	2.89
ACETONE	187.17	146.40	123.00	132.00	739.92	13.57
PROPIONALDEHYDE	38.99	30.00	0.00	45.00	159.63	2.69
CROTONALDEHYDE	59.39	34.80	8.40	28.80	63.01	2.01
ISOBUTYRALDEHYDE. NOTE H	34.19	19.80	17.40	22.20	0.00	1.28
METHYL ETHYL KETONE. NOTE H	34.19	19.80	17.40	22.20	0.00	1.28
BENZALDEHYDE	306.55	210.60	153.60	161.40	220.24	12.74
ISOVALERALDEHYDE	0.00	4.20	0.00	9.00	0.00	0.26
VALERALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00
O-TOLUALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00
M/P-TOLUALDEHYDE	293.35	186.60	138.60	84.60	236.44	10.49
HEXANALDEHYDE	0.00	0.00	29.40	0.00	0.00	0.61
DIMETHYLBENZALDEHYDE	56.99	59.40	16.80	0.00	0.00	1.57
SUMMED SPECIATED VALUES	175209	106324	96272	147198	214401	8966

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

Time	599.9	599.8	600	599.8	599.9	**Total hp**
bhp	1.5	5.6	4.5	2.5	0.3	**14.28**
Wgt. Factor	0.05	0.25	0.3	0.3	0.1	

Test No.: CHEM2E D2 Cycle	mg/hr					Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	mg/hp-hr
METHANE	26606.97	13596.46	13452.99	21785.45	59330.94	1486.98
ETHANE	995.64	905.83	716.01	812.59	1759.95	63.78
ETHYLENE	14517.68	10274.95	8907.41	10180.16	18893.76	764.02
PROPANE	85.16	42.05	29.18	61.66	149.21	3.99
PROPYLENE	6197.23	5149.13	4218.69	4120.07	6829.95	334.86
ACETYLENE	17805.20	11242.64	11740.81	21000.38	86107.10	1550.00
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	414.52	244.17	249.29	262.56	456.84	19.68
TRANS-2-BUTENE	374.88	276.94	256.55	265.98	393.88	19.90
1-BUTENE	488.65	383.90	330.89	337.24	541.13	26.26
2-METHYLPROPENE (ISOBUTYLENE)	6082.05	4650.32	4132.19	4105.53	6205.75	319.23
2,2-DIMETHYLPROPANE (NEOPENTANE)	11.00	0.00	0.00	0.00	0.00	0.04
PROPYNE	570.75	517.12	365.04	399.86	995.26	34.09
1,3-BUTADIENE	1176.59	1034.89	776.41	772.22	1367.70	64.35
2-METHYLPROPANE (ISOBUTANE)	100.40	64.85	62.82	62.59	93.43	4.78
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	299.47	221.09	203.03	215.39	309.54	15.88
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	3622.49	2229.19	2305.99	2406.25	3116.27	172.53
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	151.19	90.61	98.22	97.84	106.10	6.98
2-METHYL-1-BUTENE	342.63	297.93	276.27	283.85	401.80	21.00
PENTANE	572.13	485.23	516.38	520.47	594.53	36.44
UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1,3-BUTADIENE	528.48	435.68	416.89	400.65	511.92	30.24
TRANS-2-PENTENE	199.53	131.74	157.84	154.45	184.19	10.86
3,3-DIMETHYL-1-BUTENE	57.15	34.68	19.05	24.87	80.23	2.29
CIS-2-PENTENE	137.41	111.14	142.81	127.95	149.30	9.16
2-METHYL-2-BUTENE	618.06	395.29	459.07	465.96	516.19	32.13
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	725.31	484.93	488.03	511.04	825.78	37.80
2,2-DIMETHYLBUTANE	185.20	128.22	133.92	142.15	44.76	9.01
CYCLOPENTENE	97.47	55.40	53.84	58.66	78.51	4.22
4-METHYL-1-PENTENE	58.94	37.83	41.29	42.78	43.53	2.94
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	39.95	26.62	26.19	25.84	29.61	1.91
2,3-DIMETHYLBUTANE	891.36	506.40	602.81	632.69	684.18	42.73
MTBE	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	4888.46	2614.81	3387.09	3675.76	3821.15	238.03
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	964.96	551.13	672.30	704.85	759.30	47.28
2-METHYL-1-PENTENE	46.83	47.23	34.70	44.49	49.13	3.00
1-HEXENE	122.97	47.23	34.70	64.90	63.52	3.79
HEXANE	439.58	252.60	296.13	303.78	334.98	20.91
UNIDENTIFIED C6 OLEFINS	60.92	128.73	165.66	134.80	324.92	11.05
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	46.90	17.88	32.63	33.66	34.70	2.11
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	80.67	35.11	53.53	57.08	64.57	3.67
3-METHYL-TRANS-2-PENTENE	139.36	62.39	94.60	103.34	106.90	6.49
2-METHYL-2-PENTENE	105.45	49.76	72.15	77.79	79.79	4.95
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	39.81	18.32	25.32	23.35	36.41	1.74

ETBE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	83.50	63.26	77.33	82.27	87.10	5.36
2,2-DIMETHYLPENTANE, NOTE A	370.70	214.70	244.55	258.12	278.09	17.56
METHYLCYCLOPENTANE, NOTE A	36.26	10.19	15.06	17.53	13.67	1.09
2,4-DIMETHYLPENTANE	1504.80	837.51	1026.14	1118.53	1186.88	73.30
2,2,3-TRIMETHYLBUTANE	84.41	38.35	86.13	113.52	144.63	6.17
3,4-DIMETHYL-1-PENTENE	18.29	19.12	11.52	12.81	15.33	1.02
1-METHYLCYCLOPENTENE	115.77	86.72	91.39	104.23	92.17	6.68
BENZENE	8282.31	5190.23	4740.36	5191.99	6830.76	376.36
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	83.12	56.67	65.80	69.04	70.61	4.61
CYCLOHEXANE	41.84	25.72	33.87	34.26	42.87	2.33
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	2830.22	1505.33	1909.74	2129.48	2183.62	136.41
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	32.77	19.37	19.31	23.04	25.12	1.52
3-METHYLHEXANE	631.97	339.77	425.17	475.54	503.02	30.61
CIS-1,3-DIMETHYLCYCLOPENTANE	101.38	57.31	69.00	79.60	94.29	5.14
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	94.64	53.21	63.49	73.01	78.89	4.68
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	5156.97	2708.58	3728.83	4035.11	3964.52	256.35
2-METHYL-1-HEXENE	34.61	13.71	22.64	26.71	29.80	1.61
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	456.41	243.36	304.88	337.00	355.92	21.84
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	239.22	103.38	174.72	227.82	266.29	12.97
2-METHYL-2-HEXENE	73.33	39.43	50.56	57.23	58.03	3.62
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	57.71	31.77	38.14	44.56	43.93	2.80
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	52.97	27.68	37.92	43.00	44.29	2.68
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	54.66	27.86	34.81	43.44	39.93	2.60
METHYLCYCLOHEXANE	199.65	112.76	135.99	152.94	165.76	9.90
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	51.88	29.53	34.66	40.83	41.17	2.57
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	576.48	292.88	368.75	422.62	439.78	26.85
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	670.64	367.37	474.01	526.81	529.36	33.51
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	67.89	37.50	49.55	51.15	61.48	3.44
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	22.02	0.00	19.40	0.00	27.64	0.68
2,3,4-TRIMETHYLPENTANE	1197.47	579.73	790.11	917.78	884.14	56.41
2,3,3-TRIMETHYLPENTANE	900.50	475.58	587.72	667.16	655.49	42.43
TOLUENE	10351.63	7288.06	6152.24	6452.12	8011.86	484.74
2,3-DIMETHYLHEXANE	687.79	452.18	440.53	534.29	527.14	34.50
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE, NOTE B	110.84	45.76	82.01	93.53	67.15	5.35
4-METHYLHEPTANE	402.47	187.47	262.39	296.54	281.89	18.41
3-METHYLHEPTANE	536.02	189.23	367.76	431.56	281.80	23.96
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	503.56	262.92	344.87	395.60	388.27	24.64

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	42.13	23.58	60.74	35.58	33.61	2.82
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	77.34	63.58	0.00	69.24	0.00	2.84
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	38.96	19.87	23.63	27.70	29.58	1.77
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	20.99	17.63	14.38	12.38	0.00	0.94
1-OCTENE	0.00	0.00	0.00	0.00	57.41	0.40
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	231.62	140.56	174.31	195.80	183.20	12.33
UNIDENTIFIED C8	105.03	58.93	156.31	125.57	128.84	8.22
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE. NOTE C	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	74.96	43.35	50.91	59.01	56.69	3.73
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	27.10	17.19	16.23	20.78	19.37	1.31
2,4-DIMETHYLHEPTANE	55.37	27.91	36.81	42.34	39.51	2.62
4,4-DIMETHYLHEPTANE	17.13	13.71	13.88	14.31	13.92	0.99
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE. NOTE D	74.03	53.93	70.31	58.71	34.16	4.15
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE. NOTE E	144.07	66.06	96.99	110.62	105.91	6.76
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE. NOTE E	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	2475.85	1571.30	1667.63	1866.74	2155.26	125.52
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	8261.82	5533.56	5533.42	6034.27	6941.06	417.43
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	306.62	198.51	229.77	266.38	273.69	16.89
3-METHYLOCTANE	159.70	94.89	112.93	139.21	138.38	8.49
STYRENE	852.61	631.51	558.99	613.40	834.13	44.51
o-XYLENE	2724.69	1791.85	1865.74	2087.14	2333.17	140.29
1-NONENE	257.88	158.14	187.47	225.18	204.46	13.77
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	175.25	114.72	140.36	168.49	159.72	10.23
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	101.05	67.80	71.94	94.37	87.36	5.65
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	35.61	20.53	21.90	23.47	26.62	1.62
n-PROPYLBENZENE	381.29	208.91	349.66	296.88	298.00	20.66
1-METHYL-3-ETHYLBENZENE	1635.12	1033.56	1145.91	1331.09	1490.67	86.30
1-METHYL-4-ETHYLBENZENE	769.93	491.32	514.47	596.63	669.76	39.33
1,3,5-TRIMETHYLBENZENE	868.07	579.22	632.72	711.68	787.04	46.93
1-METHYL-2-ETHYLBENZENE	518.53	327.89	347.10	415.51	470.33	26.87
1,2,4-TRIMETHYLBENZENE	2687.26	1647.80	1655.13	2047.48	2310.34	132.22
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00
DECANE. NOTE F	33.58	5.67	6.65	12.19	14.49	0.71
ISOBUTYLBENZENE. NOTE F	31.68	5.35	6.27	12.64	13.67	0.70
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	377.75	210.32	238.30	314.02	325.56	18.89
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00

INDAN	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	480.76	309.81	282.22	352.92	532.29	24.18
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	88.39	39.36	44.85	54.25	68.02	3.56
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	54.69	18.68	15.22	0.00	33.73	1.07
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	177.15	74.88	55.56	135.65	168.03	7.12
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	168.99	50.78	75.98	134.44	189.38	7.23
TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	114.86	0.00	0.00	74.73	115.96	2.78
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	1594.38	747.03	866.36	1293.27	1483.46	74.42
FORMALDEHYDE	1816.50	1188.40	939.00	1084.56	2317.59	85.91
ACETALDEHYDE	245.44	148.85	90.00	96.63	198.63	8.78
ACROLEIN	37.81	13.80	0.00	10.20	45.61	0.91
ACETONE	390.67	262.29	194.40	211.87	324.05	16.76
PROPIONALDEHYDE	153.63	42.61	64.20	68.42	158.43	5.18
CROTONALDEHYDE	70.81	39.61	52.20	51.62	90.02	3.75
ISOBUTYRALDEHYDE, NOTE H	44.41	25.81	0.00	7.20	0.00	0.76
METHYL ETHYL KETONE, NOTE H	44.41	25.81	0.00	7.20	0.00	0.76
BENZALDEHYDE	305.45	161.45	99.00	130.24	193.83	10.07
ISOVALERALDEHYDE	0.00	33.61	0.00	0.00	15.00	0.69
VALERALDEHYDE	0.00	0.00	26.40	31.81	34.81	1.47
O-TOLUALDEHYDE	55.81	27.61	57.00	30.01	0.00	2.51
M/P-TOLUALDEHYDE	304.85	26.41	30.00	45.02	120.02	3.95
HEXANALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00
DIMETHYLBENZALDEHYDE	75.61	27.61	0.00	8.40	39.01	1.20
SUMMED SPECIATED VALUES	157394	98418	98323	122939	251653	8685

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

APPENDIX C

ENGINE B DEVELOPMENTAL EMISSION RESULTS

- DBC-6
- DBC-7
- DFB-1B
- DFB-2B
- DFB-3

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DBC-6

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/ 5/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 2

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
WITH CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	300.	2798.	23.	8.4	84.2	15.4	28.90	1.182	.941	.968	1.047
2	2100.	100.	109.	300.	2092.	109.	17.8	85.2	15.5	28.91	1.187	.940	.958	1.048
3	2100.	75.	82.	300.	2102.	83.	14.3	85.1	15.2	28.91	1.174	.943	.961	1.048
4	2100.	50.	55.	300.	2098.	55.	10.6	85.2	15.3	28.91	1.177	.943	.965	1.048
5	2100.	25.	27.	300.	2104.	27.	7.0	85.1	15.0	28.91	1.165	.946	.969	1.047
6	2100.	10.	11.	300.	2098.	11.	5.2	83.9	14.7	28.91	1.151	.950	.970	1.045
7	800.	0.	0.	300.	798.	0.	1.9	83.3	15.2	28.91	1.174	.943	.974	1.045

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	13.0	1.06	2.3	39.0	.00	11458.
2	42.0	19.41	848.9	60.1	.00	22807.
3	33.0	8.08	298.0	22.9	.00	18952.
4	22.0	4.14	122.0	6.7	.00	14127.
5	11.0	1.09	15.8	.1	.00	9418.
6	4.4	1.52	68.4	.3	.00	6955.
7	.0	1.81	.4	.5	.00	2592.

WEIGHTED RESULTS

MODE	WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.8	.51	.06	.14	2.34	.00	687.
2	.020	.8	.36	.39	16.98	1.20	.00	456.
3	.050	1.6	.72	.40	14.90	1.14	.00	948.
4	.320	7.0	3.38	1.33	39.03	2.15	.00	4521.
5	.300	3.3	2.09	.33	4.73	.02	.00	2825.
6	.100	.4	.52	.15	6.84	.03	.00	696.
7	.150	.0	.29	.27	.07	.08	.00	389.
TOTAL		14.1	7.9	2.9	82.7	7.0	.0	10522.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.00	.01	.17	.000	49.
2	.03	1.21	.09	.000	32.
3	.03	1.06	.08	.000	67.
4	.09	2.78	.15	.000	322.
5	.02	.34	.00	.000	201.
6	.01	.49	.00	.000	50.
7	.02	.00	.01	.000	28.

COMPOSITE RESULTS

BSHC ------- =	.21	G/HP-HR	=	.28	G/KW-HR
BSCO ------- =	5.88	G/HP-HR	=	7.89	G/KW-HR
BSNOx ------ =	.50	G/HP-HR	=	.66	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	749.	G/HP-HR	=	1004.	G/KW-HR
BSFC ------- =	.559	LB/HP-HR	=	.340	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-20

DBC-6

ENGINE NUMBER	TEST	RUN	LPG	LPG
ENGINE MODEL	DATE 6/ 5/98	TIME	HCR 2.67	
ENGINE	COMPUTER PROGRAM	SSDIL 1.3 -R	C:.817 H:.183 O:.000 X:.000	
ENGINE CYCLE OTTO	CELL 13 B	BAG CART 2	ENGINE OIL	
			WITH CATALYST	

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	97.9 (28.90)	97.9 (28.91)	97.9 (28.91)	97.9 (28.91)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	26.1 (79.0)/13.4	26.1 (79.0)/14.2	26.1 (79.0)/14.2	26.1 (79.0)/14
ENGINE AIR DEW PT., DEG. C (DEG. F)	20.1 (68.2)	20.2 (68.4)	19.9 (67.9)	20.0 (68.0)
ENGINE AIR TEMP, DEG. C (DEG. F)	29.0 (84.2)	29.6 (85.2)	29.5 (85.1)	29.6 (85.2)
ENGINE AIR: RH,% / AH,G/KG	59./ 15.4	57./ 15.5	56./ 15.2	57./ 15.3
NOx HUMIDITY C.F.	1.182	1.187	1.174	1.177
DRY-TO-WET C.F.	.968	.958	.961	.965
TIME SECONDS	300.1	300.1	299.9	300.1
TOT. BLOWER RATE, SCMM (SCFM)*	11.96 (513.5)	11.91 (511.3)	11.95 (512.7)	11.98 (514.3)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	59.8 (2568.)	59.6 (2557.)	59.7 (2563.)	59.9 (2572.)
HC SAMPLE METER/RANGE/PPM	6.0/ 2/ 6.0	40.4/ 2/ 40.4	19.2/ 2/ 19.2	11.9/ 2/ 11.9
HC BCKGRD METER/RANGE/PPM	4.3/ 2/ 4.3	4.4/ 2/ 4.4	4.5/ 2/ 4.5	4.5/ 2/ 4.5
CO SAMPLE METER/RANGE/PPM	6.3/ 12/ 6.1	47.3/ 2/ 889.7	67.4/ 14/ 311.7	55.3/ 13/ 127.7
CO BCKGRD METER/RANGE/PPM	4.1/ 12/ 4.0	.1/ 2/ 1.4	.7/ 14/ 2.8	1.2/ 13/ 2.6
CO2 SAMPLE METER/RANGE/PCT	77.8/ 11/ .7715	79.6/ 1/ 1.4796	66.4/ 1/ 1.2401	93.4/ 11/ .9338
CO2 BCKGRD METER/RANGE/PCT	6.1/ 11/ .0575	2.7/ 1/ .0515	3.0/ 1/ .0572	5.8/ 11/ .0547
NOX SAMPLE METER/RANGE/PPM	80.5/ 1/ 20.2	30.6/ 2/ 30.7	47.2/ 1/ 11.8	14.1/ 1/ 3.5
NOX BCKGRD METER/RANGE/PPM	1.7/ 1/ .4	.2/ 2/ .2	.6/ 1/ .2	.5/ 1/ .1
DILUTION FACTOR	15.04	7.41	9.14	12.27
HC CONCENTRATION PPM	1.98	36.57	15.18	7.76
CO CONCENTRATION PPM	2.24	839.34	293.83	119.89
CO2 CONCENTRATION PCT	.7178	1.4350	1.1891	.8836
NOX CONCENTRATION PPM	19.76	30.48	11.69	3.42
HC MASS GRAMS	.088	1.618	.673	.346
CO MASS GRAMS	.190	70.764	24.827	10.168
CO2 MASS GRAMS	955.17	1901.20	1578.83	1177.63
NOX MASS GRAMS	3.249	5.010	1.905	.560
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.319 (.70)	.674 (1.49)	.541 (1.19)	.399 (.88)
KW HR (HP HR)	.81 (1.08)	2.61 (3.50)	2.05 (2.75)	1.37 (1.83)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2568.3	2557.1	2562.8	2572.5
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DBC-6

ENGINE NUMBER	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 6/ 5/98 TIME		HCR 2.67
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R		C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2		ENGINE OIL
			WITH CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	97.9 (28.91)	97.9 (28.91)	97.9 (28.91)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	26.1 (79.0)/14.2	26.7 (80.0)/14.8	26.7 (80.0)/14.8
ENGINE AIR DEW PT., DEG. C (DEG. F)	19.7 (67.5)	19.4 (66.9)	19.9 (67.9)
ENGINE AIR TEMP, DEG. C (DEG. F)	29.5 (85.1)	28.8 (83.9)	28.5 (83.3)
ENGINE AIR: RH,% / AH,G/KG	56./ 15.0	57./ 14.7	60./ 15.2
NOx HUMIDITY C.F.	1.165	1.151	1.174
DRY-TO-WET C.F.	.969	.970	.974
TIME SECONDS	300.0	300.4	299.9
TOT. BLOWER RATE, SCMM (SCFM)*	11.97 (513.5)	11.98 (514.3)	11.97 (513.7)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	59.8 (2568.)	60.0 (2575.)	59.8 (2568.)
HC SAMPLE METER/RANGE/PPM	7.9/ 2/ 7.9	8.5/ 2/ 8.5	8.8/ 2/ 8.8
HC BCKGRD METER/RANGE/PPM	6.2/ 2/ 6.2	5.9/ 2/ 5.9	5.5/ 2/ 5.5
CO SAMPLE METER/RANGE/PPM	19.5/ 12/ 18.9	75.8/ 12/ 74.8	4.2/ 12/ 4.1
CO BCKGRD METER/RANGE/PPM	3.0/ 12/ 2.9	5.7/ 12/ 5.5	3.8/ 12/ 3.7
CO2 SAMPLE METER/RANGE/PCT	65.1/ 11/ .6407	50.2/ 11/ .4892	22.8/ 11/ .2178
CO2 BCKGRD METER/RANGE/PCT	5.7/ 11/ .0537	6.0/ 11/ .0566	6.0/ 11/ .0566
NOX SAMPLE METER/RANGE/PPM	.9/ 1/ .2	1.5/ 1/ .4	2.4/ 1/ .6
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .2	1.0/ 1/ .3	1.4/ 1/ .4
DILUTION FACTOR	18.07	23.37	53.05
HC CONCENTRATION PPM	2.04	2.85	3.40
CO CONCENTRATION PPM	15.53	67.20	.43
CO2 CONCENTRATION PCT	.5900	.4351	.1623
NOX CONCENTRATION PPM	.04	.14	.26
HC MASS GRAMS	.091	.127	.151
CO MASS GRAMS	1.315	5.705	.036
CO2 MASS GRAMS	784.82	580.40	215.92
NOX MASS GRAMS	.006	.022	.042
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.263 (.58)	.197 (.43)	.072 (.16)
KW HR (HP HR)	.68 (.92)	.27 (.37)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	2567.7	2574.7	2567.7
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS

PBC-7

PROJECT NO. 08-8778

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/ 8/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.0
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	300.	2804.	23.	8.8	83.9	13.5	28.98	1.099	.965	.969	1.040
2	2100.	100.	109.	300.	2106.	109.	17.6	83.9	13.7	28.98	1.109	.962	.961	1.041
3	2100.	75.	81.	300.	2094.	83.	14.2	84.3	14.5	28.97	1.140	.953	.963	1.043
4	2100.	50.	54.	300.	2104.	55.	10.0	84.4	13.8	28.97	1.113	.960	.967	1.042
5	2100.	25.	27.	301.	2098.	28.	6.7	83.9	13.5	28.96	1.102	.964	.971	1.041
6	2100.	10.	11.	300.	2102.	12.	5.1	83.4	13.5	28.96	1.102	.964	.972	1.041
7	800.	0.	0.	300.	804.	0.	1.8	82.4	13.1	28.95	1.087	.969	.977	1.039

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	12.0	.62	9.7	.0	.00	11897.
2	43.0	19.49	691.5	.6	.00	22731.
3	33.0	11.24	242.4	.3	.00	18804.
4	22.0	.61	6.0	.0	.00	13585.
5	11.0	.07	.8	.2	.00	9026.
6	4.0	.10	5.6	.0	.00	6855.
7	.0	.15	.1	.0	.00	2459.

WEIGHTED RESULTS

MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
.060	.7	.53	.04	.58	.00	.00	714.
.020	.9	.35	.39	13.83	.01	.00	455.
.050	1.6	.71	.56	12.12	.01	.00	940.
.320	7.0	3.21	.20	1.90	.01	.00	4347.
.300	3.3	2.00	.02	.25	.06	.00	2708.
.100	.4	.51	.01	.56	.00	.00	686.
.150	.0	.27	.02	.01	.00	.00	369.
TOTAL	14.0	7.6	1.2	29.3	.1	.0	10218.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.00	.04	.00	.000	51.
2	.03	.99	.00	.000	33.
3	.04	.87	.00	.000	67.
4	.01	.14	.00	.000	311.
5	.00	.02	.00	.000	194.
6	.00	.04	.00	.000	49.
7	.00	.00	.00	.000	26.

COMPOSITE RESULTS

BSHC	=	.09	G/HP-HR	=	.12 G/KW-HR
BSCO	=	2.10	G/HP-HR	=	2.81 G/KW-HR
BSNOx	=	.01	G/HP-HR	=	.01 G/KW-HR
PARTICULATE	=	.000	G/HP-HR	=	.000 G/KW-HR
BSCO2	=	732.	G/HP-HR	=	981. G/KW-HR
BSFC	=	.542	LB/HP-HR	=	.329 kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DBC-7

ENGINE NUMBER	TEST RUN	LPG LPG	
ENGINE MODEL	DATE 6/ 8/98 TIME	HCR 2.67	
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.817 H:.183 O:.000 X:.000	
ENGINE CYCLE OTTO	CELL 13 B BAG CART 1	ENGINE OIL	
		RANGER CATALYST	

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.1 (28.98)	98.1 (28.98)	98.1 (28.97)	98.1 (28.97)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/12.8	24.4 (76.0)/12.5	25.0 (77.0)/13.0	25.0 (77.0)/13.0
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.1 (64.5)	18.3 (65.0)	19.2 (66.5)	18.4 (65.2)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.8 (83.9)	28.8 (83.9)	29.1 (84.3)	29.1 (84.4)
ENGINE AIR: RH,% / AH,G/KG	52./ 13.5	53./ 13.7	55./ 14.5	53./ 13.8
NOx HUMIDITY C.F.	1.099	1.109	1.140	1.113
DRY-TO-WET C.F.	.969	.961	.963	.967
TIME SECONDS	300.0	300.0	300.0	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	12.03 (516.4)	11.98 (514.0)	11.99 (514.7)	12.01 (515.3)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	60.2 (2582.)	59.9 (2570.)	60.0 (2573.)	60.0 (2577.)
HC SAMPLE METER/RANGE/PPM	4.6/ 2/ 4.6	40.0/ 2/ 40.0	24.7/ 2/ 24.7	5.3/ 2/ 5.3
HC BCKGRD METER/RANGE/PPM	3.7/ 2/ 3.7	4.0/ 2/ 4.0	4.1/ 2/ 4.1	4.5/ 2/ 4.5
CO SAMPLE METER/RANGE/PPM	10.6/ 12/ 10.1	34.9/ 3/ 719.3	56.9/ 14/ 250.3	6.4/ 12/ 6.1
CO BCKGRD METER/RANGE/PPM	.3/ 12/ .3	.0/ 3/ .0	.0/ 14/ .0	.0/ 12/ .0
CO2 SAMPLE METER/RANGE/PCT	83.8/ 11/ .7829	75.0/ 3/ 1.4637	64.1/ 3/ 1.2238	90.9/ 11/ .8931
CO2 BCKGRD METER/RANGE/PCT	6.7/ 11/ .0448	2.7/ 3/ .0474	3.1/ 3/ .0544	7.3/ 11/ .0489
NOX SAMPLE METER/RANGE/PPM	.5/ 1/ .1	1.6/ 1/ .4	1.4/ 1/ .3	.7/ 1/ .2
NOX BCKGRD METER/RANGE/PPM	.5/ 1/ .1	.4/ 1/ .1	.9/ 1/ .2	.7/ 1/ .2
DILUTION FACTOR	14.82	7.57	9.30	13.00
HC CONCENTRATION PPM	1.15	36.52	21.04	1.15
CO CONCENTRATION PPM	9.48	680.06	238.04	5.84
CO2 CONCENTRATION PCT	.7411	1.4226	1.1753	.8480
NOX CONCENTRATION PPM	.01	.31	.15	.01
HC MASS GRAMS	.051	1.624	.937	.051
CO MASS GRAMS	.807	57.624	20.196	.496
CO2 MASS GRAMS	991.46	1894.27	1567.00	1132.10
NOX MASS GRAMS	.001	.048	.024	.002
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.332 (.73)	.665 (1.47)	.535 (1.18)	.379 (.83)
KW HR (HP HR)	.75 (1.00)	2.67 (3.58)	2.05 (2.75)	1.37 (1.83)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2582.0	2570.0	2573.4	2576.7
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DBC-7

ENGINE NUMBER	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 6/ 8/98	TIME	HCR 2.67
ENGINE	COMPUTER PROGRAM	SSDIL 1.3 -R	C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B	BAG CART 1	ENGINE OIL
			RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.1 (28.96)	98.0 (28.96)	98.0 (28.95)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	25.0 (77.0)/13.1	23.9 (75.0)/13.5	25.0 (77.0)/13.1
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.1 (64.6)	18.1 (64.6)	17.7 (63.8)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.8 (83.9)	28.6 (83.4)	28.0 (82.4)
ENGINE AIR: RH,% / AH,G/KG	52./ 13.5	53./ 13.5	53./ 13.1
NOx HUMIDITY C.F.	1.102	1.102	1.087
DRY-TO-WET C.F.	.971	.972	.977
TIME SECONDS	300.8	299.9	300.1
TOT. BLOWER RATE, SCMM (SCFM)*	12.03 (516.2)	12.02 (515.9)	11.98 (514.0)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	60.3 (2588.)	60.1 (2579.)	59.9 (2571.)
HC SAMPLE METER/RANGE/PPM	4.2/ 2/ 4.2	4.6/ 2/ 4.6	5.1/ 2/ 5.1
HC BCKGRD METER/RANGE/PPM	4.3/ 2/ 4.3	4.6/ 2/ 4.6	4.9/ 2/ 4.9
CO SAMPLE METER/RANGE/PPM	1.0/ 12/ .9	6.2/ 12/ 5.9	.4/ 12/ .4
CO BCKGRD METER/RANGE/PPM	.1/ 12/ .1	.2/ 12/ .2	.3/ 12/ .3
CO2 SAMPLE METER/RANGE/PCT	70.9/ 11/ .6069	95.0/ 12/ .4762	82.2/ 13/ .2021
CO2 BCKGRD METER/RANGE/PCT	7.0/ 11/ .0468	11.7/ 12/ .0508	20.4/ 13/ .0491
NOX SAMPLE METER/RANGE/PPM	.7/ 1/ .2	1.0/ 1/ .2	1.5/ 1/ .4
NOX BCKGRD METER/RANGE/PPM	.3/ 1/ .1	1.0/ 1/ .2	1.6/ 1/ .4
DILUTION FACTOR	19.14	24.36	57.35
HC CONCENTRATION PPM	.12	.19	.29
CO CONCENTRATION PPM	.82	5.52	.10
CO2 CONCENTRATION PCT	.5625	.4275	.1539
NOX CONCENTRATION PPM	.10	.01	-.02
HC MASS GRAMS	.006	.008	.013
CO MASS GRAMS	.070	.469	.008
CO2 MASS GRAMS	754.17	571.08	205.00
NOX MASS GRAMS	.016	.002	.000
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.252 (.56)	.191 (.42)	.069 (.15)
KW HR (HP HR)	.69 (.92)	.25 (.33)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	2587.7	2578.6	2571.1
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-1B

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/ 9/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	600.	2796.	23.	8.1	80.9	14.8	29.07	1.154	.949	.969	1.035
2	2100.	100.	109.	600.	2094.	109.	17.6	82.7	14.6	29.07	1.147	.951	.962	1.038
3	2100.	75.	82.	600.	2102.	83.	13.7	83.4	14.2	29.06	1.128	.956	.966	1.038
4	2100.	50.	55.	600.	2104.	54.	9.5	82.3	15.9	29.08	1.205	.936	.967	1.039
5	2100.	25.	27.	600.	2104.	28.	6.8	83.0	13.9	29.13	1.118	.959	.972	1.035
6	2100.	10.	11.	600.	2102.	11.	5.2	82.0	13.6	29.13	1.106	.963	.974	1.033
7	800.	0.	0.	600.	778.	0.	1.8	80.0	13.2	29.13	1.091	.967	.978	1.030

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	11.0	1.69	8.9	.0	.00	10974.
2	42.0	18.44	587.0	.8	.00	22870.
3	33.0	12.29	238.6	.4	.00	18232.
4	21.0	6.17	90.0	.8	.00	12775.
5	11.0	.43	13.1	.4	.00	9264.
6	4.0	.63	5.1	.0	.00	7011.
7	.0	2.06	.1	.7	.00	2485.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.49	.10	.54	.00	.00	658.
2	.020	.8	.35	.37	11.74	.02	.00	457.
3	.050	1.6	.69	.61	11.93	.02	.00	912.
4	.320	6.7	3.05	1.97	28.81	.26	.00	4088.
5	.300	3.3	2.05	.13	3.94	.12	.00	2779.
6	.100	.4	.52	.06	.51	.00	.00	701.
7	.150	.0	.28	.31	.02	.10	.00	373.
TOTAL		13.6	7.4	3.6	57.5	.5	.0	9969.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.01	.04	.00	.000	49.
2	.03	.87	.00	.000	34.
3	.05	.88	.00	.000	67.
4	.15	2.12	.02	.000	301.
5	.01	.29	.01	.000	205.
6	.00	.04	.00	.000	52.
7	.02	.00	.01	.000	27.

COMPOSITE RESULTS

BSHC ------- =	.26	G/HP-HR	=	.35	G/KW-HR
BSCO ------- =	4.24	G/HP-HR	=	5.68	G/KW-HR
BSNOx ------ =	.04	G/HP-HR	=	.05	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	735.	G/HP-HR	=	985.	G/KW-HR
BSFC ------- =	.547	LB/HP-HR	=	.333	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-1B

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/ 9/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.4 (29.07)	98.4 (29.07)	98.4 (29.06)	98.5 (29.08)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/13.5	23.9 (75.0)/11.2	23.3 (74.0)/11.5	23.9 (75.0)/13.
ENGINE AIR DEW PT., DEG. C (DEG. F)	19.6 (67.2)	19.4 (66.9)	18.9 (66.0)	20.7 (69.3)
ENGINE AIR TEMP, DEG. C (DEG. F)	27.2 (80.9)	28.2 (82.7)	28.6 (83.4)	27.9 (82.3)
ENGINE AIR: RH,% / AH,G/KG	63./ 14.8	59./ 14.6	56./ 14.2	65./ 15.9
NOx HUMIDITY C.F.	1.154	1.147	1.128	1.205
DRY-TO-WET C.F.	.969	.962	.966	.967
TIME SECONDS	600.1	600.1	600.0	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	12.03 (516.5)	12.01 (515.5)	12.03 (516.2)	11.69 (501.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	120.4 (5166.)	120.1 (5156.)	120.3 (5162.)	116.9 (5018.)
HC SAMPLE METER/RANGE/PPM	6.8/ 2/ 6.8	38.1/ 2/ 38.1	26.7/ 2/ 26.7	18.4/ 2/ 18.4
HC BCKGRD METER/RANGE/PPM	3.9/ 2/ 3.9	4.2/ 2/ 4.2	4.2/ 2/ 4.2	7.1/ 2/ 7.1
CO SAMPLE METER/RANGE/PPM	11.3/ 12/ 10.8	30.3/ 3/ 609.5	56.2/ 14/ 246.8	95.8/ 12/ 96.6
CO BCKGRD METER/RANGE/PPM	1.9/ 12/ 1.8	.1/ 3/ 1.7	.4/ 14/ 1.5	2.0/ 12/ 1.9
CO2 SAMPLE METER/RANGE/PCT	80.8/ 11/ .7393	75.4/ 3/ 1.4728	62.5/ 3/ 1.1896	90.1/ 11/ .8802
CO2 BCKGRD METER/RANGE/PCT	8.9/ 11/ .0596	3.0/ 3/ .0526	3.4/ 3/ .0597	9.9/ 11/ .0664
NOX SAMPLE METER/RANGE/PPM	.7/ 1/ .2	2.9/ 1/ .7	1.4/ 1/ .3	2.4/ 1/ .6
NOX BCKGRD METER/RANGE/PPM	.7/ 1/ .2	1.5/ 1/ .4	.7/ 1/ .2	.8/ 1/ .2
DILUTION FACTOR	15.69	7.58	9.56	13.04
HC CONCENTRATION PPM	3.15	34.45	22.94	11.84
CO CONCENTRATION PPM	8.74	575.53	233.66	90.69
CO2 CONCENTRATION PCT	.6835	1.4271	1.1362	.8189
NOX CONCENTRATION PPM	.01	.40	.19	.42
HC MASS GRAMS	.281	3.074	2.049	1.028
CO MASS GRAMS	1.488	97.842	39.768	15.005
CO2 MASS GRAMS	1829.2	3812.4	3038.7	2129.2
NOX MASS GRAMS	.004	.128	.061	.136
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.612 (1.35)	1.328 (2.93)	1.038 (2.29)	.720 (1.59)
KW HR (HP HR)	1.37 (1.83)	5.22 (7.00)	4.10 (5.50)	2.61 (3.50)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	5165.8	5156.3	5162.2	5018.3
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-1B

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/ 9/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.6 (29.13)	98.6 (29.13)	98.6 (29.13)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/12.2	23.3 (74.0)/12.2	23.3 (74.0)/12.2
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.7 (65.6)	18.3 (65.0)	17.9 (64.2)
ENGINE AIR TEMP, DEG. C (DEG. F)	28.3 (83.0)	27.8 (82.0)	26.7 (80.0)
ENGINE AIR: RH,% / AH,G/KG	56./ 13.9	56./ 13.6	59./ 13.2
NOx HUMIDITY C.F.	1.118	1.106	1.091
DRY-TO-WET C.F.	.972	.974	.978
TIME SECONDS	600.0	600.0	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	12.01 (515.2)	12.01 (515.3)	11.95 (512.9)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	120.1 (5152.)	120.1 (5153.)	119.5 (5129.)
HC SAMPLE METER/RANGE/PPM	4.5/ 2/ 4.5	5.2/ 2/ 5.2	7.9/ 2/ 7.9
HC BCKGRD METER/RANGE/PPM	3.9/ 2/ 3.9	4.2/ 2/ 4.2	4.1/ 2/ 4.1
CO SAMPLE METER/RANGE/PPM	15.4/ 12/ 14.8	6.6/ 12/ 6.3	1.4/ 12/ 1.3
CO BCKGRD METER/RANGE/PPM	1.6/ 12/ 1.5	1.2/ 12/ 1.1	1.3/ 12/ 1.2
CO2 SAMPLE METER/RANGE/PCT	72.8/ 11/ .6310	60.8/ 11/ .4889	84.3/ 13/ .2077
CO2 BCKGRD METER/RANGE/PCT	8.3/ 11/ .0556	8.0/ 11/ .0536	22.0/ 13/ .0528
NOX SAMPLE METER/RANGE/PPM	1.6/ 1/ .4	1.4/ 1/ .3	1.8/ 1/ .4
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .2	1.5/ 1/ .4	.3/ 1/ .1
DILUTION FACTOR	18.37	23.72	55.70
HC CONCENTRATION PPM	.81	1.18	3.87
CO CONCENTRATION PPM	12.87	5.01	.11
CO2 CONCENTRATION PCT	.5784	.4376	.1558
NOX CONCENTRATION PPM	.21	-.01	.38
HC MASS GRAMS	.072	.105	.344
CO MASS GRAMS	2.186	.852	.018
CO2 MASS GRAMS	1544.1	1168.5	414.1
NOX MASS GRAMS	.066	.000	.114
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.517 (1.14)	.391 (.86)	.139 (.31)
KW HR (HP HR)	1.37 (1.83)	.50 (.67)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	5152.3	5153.4	5128.8
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: DFB-1B
FUEL: LPG HD5
ENGINE: B

PROJECT: 08-8778-202
TEST DATE: 06/09/98

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	5166	5156	5162	5018	5152	5153	5129	
Work, hp-hr	1.83	7	5.5	3.5	1.83	0.67	0	2.261
Dilution Factor	15.69	7.58	9.56	13.04	18.37	23.72	55.70	
HC Sample, ppm	6.8	38.1	26.7	18.4	4.5	5.2	7.9	
HC Background, ppm	3.9	4.2	4.2	7.1	3.9	4.2	4.1	
CH4 Sample, ppm	3.42	6.33	5.29	3.71	2.8	3.12	3.06	
CH4 Background, ppm	2.56	2.56	2.56	2.37	2.74	2.74	2.74	
NMHC Sample, ppm	2.8	30.7	20.5	14.0	1.2	1.5	4.3	
NMHC Background, ppm	0.9	1.2	1.2	4.3	0.7	1.0	0.9	
THC Sample, ppm	6.2	37.0	25.8	17.8	4.0	4.7	7.4	
THC Background, ppm	3.5	3.8	3.8	6.7	3.4	3.7	3.6	
HC Concentration, ppm	3.1	34.5	22.9	11.8	0.8	1.2	3.9	
CH4 Concentration, ppm	1.0	4.1	3.0	1.5	0.2	0.5	0.4	
HMHC Concentration, ppm	1.9	29.6	19.4	10.1	0.6	0.6	3.4	
THC Mass, gram	0.28	3.07	2.05	1.03	0.07	0.10	0.34	0.59
CH4 Mass, gram	0.10	0.40	0.29	0.14	0.02	0.05	0.04	0.09
NMHC Mass, gram	0.17	2.64	1.73	0.87	0.05	0.05	0.31	0.50
THC, g/hp-hr	0.15	0.44	0.37	0.29	0.04	0.16		0.26
CH4, g/hp-hr	0.05	0.06	0.05	0.04	0.01	0.07		0.04
NMHC, g/hp-hr	0.10	0.38	0.32	0.25	0.03	0.08		0.22

Time	600.1	600.1	600	600	600	600	600	**Total hp**
bhp	0.7	0.9	1.6	6.7	3.3	0.4	0	**13.6**
Wgt. Factor	0.06	0.02	0.05	0.32	0.3	0.1	0.15	
				6/12				

Test No.: DFB-1B	mg/hr							Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	mg/hp-hr
METHANE	601.73	2401.00	1756.23	867.03	123.79	289.79	213.22	40.26
ETHANE	114.99	717.99	551.88	318.21	0.50	5.95	161.94	12.92
ETHYLENE	69.88	1353.99	978.80	453.31	4.93	0.00	0.00	16.67
PROPANE	508.34	11178.38	8224.31	4501.22	96.11	64.89	1225.74	170.95
PROPYLENE	24.70	1063.02	627.60	155.38	11.79	2.18	9.70	8.02
ACETYLENE	0.00	0.00	0.00	3.07	0.00	0.00	0.00	0.07
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	43.24	252.07	239.26	58.41	0.00	0.00	21.41	3.05
TRANS-2-BUTENE	0.00	2.07	0.00	0.00	0.00	0.00	0.00	0.00
1-BUTENE	0.00	7.14	4.32	3.48	0.00	0.00	0.00	0.11
2-METHYLPROPENE (ISOBUTYLENE)	0.00	31.87	19.76	7.26	4.37	0.00	0.00	0.39
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	12.75	0.00	0.00	0.00	0.00	3.11	0.00	0.08
1,3-BUTADIENE	0.00	25.38	17.88	1.56	3.39	3.08	4.72	0.29
2-METHYLPROPANE (ISOBUTANE)	11.74	298.27	221.36	84.30	1.89	0.00	15.20	3.50
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	0.00	14.94	4.85	0.00	0.00	0.00	0.00	0.04
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENTANE	0.00	5.79	0.00	9.07	0.00	0.00	0.00	0.22
UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1,3-BUTADIENE	4.83	11.60	0.55	0.00	2.11	8.89	0.00	0.15
TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00
MTBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	0.00	2.20	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXANE	0.00	1.15	0.00	0.00	0.00	0.66	0.00	0.01
UNIDENTIFIED C6 OLEFINS	0.00	0.00	3.97	0.00	0.00	0.00	0.00	0.01
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ETBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLPENTANE. NOTE A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOPENTANE. NOTE A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLPENTANE	0.00	0.00	0.04	0.00	0.00	0.43	76.64	0.85
2,2,3-TRIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZENE	0.00	24.99	8.97	4.25	2.84	0.00	0.90	0.24
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	0.00	0.73	1.39	0.00	0.00	0.00	0.00	0.01
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEXANE	0.00	3.28	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	3.86	0.00	0.03
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	0.00	2.82	0.00	0.00	0.00	1.27	0.00	0.01
2-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.01
2,3,3-TRIMETHYLPENTANE	0.14	0.00	3.56	0.00	0.00	0.00	0.00	0.01
TOLUENE	0.00	3.50	0.00	2.88	0.00	0.02	0.00	0.07
2,3-DIMETHYLHEXANE	5.04	4.26	0.00	0.00	0.00	0.00	0.00	0.03
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE. NOTE B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE. NOTE C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE. NOTE D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE. NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE. NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	0.00	0.00	0.00	0.00	6.70	4.25	0.00	0.18
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STYRENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
o-XYLENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DECANE. NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYLBENZENE. NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

INDAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,4-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
UNDECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORMALDEHYDE	0.00	0.00	6.60	4.80	0.00	0.00	0.00	0.14
ACETALDEHYDE	7.20	0.00	2.40	0.00	0.00	0.00	0.00	0.04
ACROLEIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACETONE	3.00	9.00	3.60	0.00	4.20	4.80	1.20	0.18
PROPIONALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROTONALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYRALDEHYDE, NOTE H	0.00	0.00	0.00	0.00	0.00	2.40	3.60	0.06
METHYL ETHYL KETONE, NOTE H	0.00	0.00	0.00	0.00	0.00	2.40	3.60	0.06
BENZALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOVALERALDEHYDE	0.00	0.00	0.00	8.40	10.20	7.80	0.00	0.48
VALERALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	11.40	0.13
O-TOLUALDEHYDE	14.40	0.00	0.00	0.00	0.00	0.00	0.00	0.06
M/P-TOLUALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXANALDEHYDE	9.60	0.00	0.00	10.20	0.00	0.00	0.00	0.28
DIMETHYLBENZALDEHYDE	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.01
SUMMED SPECIATED VALUES	1431.56	17415.43	12680.33	6492.85	272.82	407.13	1749.27	259.62

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-2B

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/10/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	600.	2800.	23.	8.4	81.0	13.4	29.12	1.099	.965	.973	1.031
2	2100.	100.	109.	600.	2096.	109.	17.7	76.8	14.1	29.10	1.125	.957	.959	1.028
3	2100.	75.	82.	600.	2102.	82.	13.9	76.5	14.6	29.10	1.146	.951	.962	1.028
4	2100.	50.	55.	600.	2094.	54.	9.9	79.9	16.1	29.09	1.213	.934	.965	1.035
5	2100.	25.	27.	600.	2110.	28.	7.2	79.9	14.6	29.11	1.146	.951	.970	1.032
6	2100.	10.	11.	600.	2112.	12.	5.4	79.9	14.1	29.09	1.125	.957	.971	1.032
7	800.	0.	0.	600.	788.	0.	1.9	78.5	14.1	29.09	1.125	.957	.975	1.030

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	11.0	2.00	10.1	.3	.00	11363.
2	43.0	13.84	526.5	.7	.00	23128.
3	32.0	7.53	125.0	.5	.00	18621.
4	21.0	6.11	100.2	.7	.00	13314.
5	12.0	2.18	21.7	.0	.00	9731.
6	4.0	.37	1.8	.0	.00	7278.
7	.0	.41	.4	.0	.00	2576.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.50	.12	.60	.02	.00	682.
2	.020	.9	.35	.28	10.53	.01	.00	463.
3	.050	1.6	.69	.38	6.25	.03	.00	931.
4	.320	6.7	3.18	1.95	32.07	.21	.00	4260.
5	.300	3.6	2.16	.65	6.52	.01	.00	2919.
6	.100	.4	.54	.04	.18	.00	.00	728.
7	.150	.0	.28	.06	.06	.00	.00	386.
TOTAL		13.8	7.7	3.5	56.2	.3	.0	10369.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.01	.04	.00	.000	49.
2	.02	.76	.00	.000	33.
3	.03	.45	.00	.000	67.
4	.14	2.32	.02	.000	308.
5	.05	.47	.00	.000	211.
6	.00	.01	.00	.000	53.
7	.00	.00	.00	.000	28.

COMPOSITE RESULTS

BSHC ------- =	.25	G/HP-HR	=	.34	G/KW-HR
BSCO ------- =	4.06	G/HP-HR	=	5.45	G/KW-HR
BSNOx ------ =	.02	G/HP-HR	=	.03	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	749.	G/HP-HR	=	1005.	G/KW-HR
BSFC ------- =	.557	LB/HP-HR	=	.339	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS

PROJECT NO. 08-8778-2C

DFB-2B

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/10/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 1

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.6 (29.12)	98.5 (29.10)	98.5 (29.10)	98.5 (29.09)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/10.7	22.2 (72.0)/13.4	22.2 (72.0)/13.4	23.9 (75.0)/1
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.1 (64.6)	18.8 (65.9)	19.4 (66.9)	20.9 (69.6)
ENGINE AIR TEMP, DEG. C (DEG. F)	27.2 (81.0)	24.9 (76.8)	24.7 (76.5)	26.6 (79.9)
ENGINE AIR: RH,% / AH,G/KG	58./ 13.4	69./ 14.1	72./ 14.6	71./ 16.1
NOx HUMIDITY C.F.	1.099	1.125	1.146	1.213
DRY-TO-WET C.F.	.973	.959	.962	.965
TIME SECONDS	600.1	600.0	599.9	599.9
TOT. BLOWER RATE, SCMM (SCFM)*	11.88 (509.9)	11.84 (508.1)	11.84 (508.0)	11.75 (504.1)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	118.8 (5100.)	118.4 (5081.)	118.3 (5079.)	117.4 (5041.)
HC SAMPLE METER/RANGE/PPM	7.7/ 2/ 7.7	29.7/ 2/ 29.7	18.3/ 2/ 18.3	16.0/ 2/ 16.0
HC BCKGRD METER/RANGE/PPM	4.2/ 2/ 4.2	4.0/ 2/ 4.0	4.5/ 2/ 4.5	4.7/ 2/ 4.7
CO SAMPLE METER/RANGE/PPM	12.6/ 12/ 12.1	28.1/ 3/ 558.9	57.2/ 13/ 133.9	46.4/ 13/ 107.1
CO BCKGRD METER/RANGE/PPM	1.9/ 12/ 1.8	.1/ 3/ 1.7	1.2/ 13/ 2.6	.9/ 13/ 2.0
CO2 SAMPLE METER/RANGE/PCT	82.8/ 11/ .7682	76.9/ 3/ 1.5068	64.5/ 3/ 1.2324	91.9/ 11/ .9094
CO2 BCKGRD METER/RANGE/PCT	8.2/ 11/ .0549	2.8/ 3/ .0491	3.4/ 3/ .0597	9.7/ 11/ .0650
NOX SAMPLE METER/RANGE/PPM	1.4/ 1/ .3	1.7/ 1/ .4	1.8/ 1/ .4	1.9/ 1/ .5
NOX BCKGRD METER/RANGE/PPM	.9/ 1/ .2	.1/ 1/ .0	.8/ 1/ .2	.6/ 1/ .1
DILUTION FACTOR	15.09	7.44	9.32	12.62
HC CONCENTRATION PPM	3.78	26.23	14.28	11.67
CO CONCENTRATION PPM	9.99	523.76	124.38	100.50
CO2 CONCENTRATION PCT	.7169	1.4642	1.1792	.8495
NOX CONCENTRATION PPM	.14	.40	.27	.34
HC MASS GRAMS	.333	2.307	1.255	1.018
CO MASS GRAMS	1.679	87.742	20.829	16.702
CO2 MASS GRAMS	1894.2	3854.6	3102.9	2218.6
NOX MASS GRAMS	.042	.125	.086	.112
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.634 (1.40)	1.336 (2.95)	1.049 (2.31)	.751 (1.66)
KW HR (HP HR)	1.37 (1.83)	5.34 (7.17)	3.98 (5.33)	2.61 (3.50)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	5099.5	5081.1	5079.1	5040.6
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-2B

ENGINE NUMBER	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 6/10/98	TIME	HCR 2.67
ENGINE	COMPUTER PROGRAM	SSDIL 1.3 -R	C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B	BAG CART 1	ENGINE OIL
			RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.6 (29.11)	98.5 (29.09)	98.5 (29.09)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/13.5	23.3 (74.0)/13.7	23.3 (74.0)/13.7
ENGINE AIR DEW PT., DEG. C (DEG. F)	19.4 (66.9)	18.8 (65.9)	18.8 (65.9)
ENGINE AIR TEMP, DEG. C (DEG. F)	26.6 (79.9)	26.6 (79.9)	25.8 (78.5)
ENGINE AIR: RH,% / AH,G/KG	65./ 14.6	62./ 14.1	65./ 14.1
NOx HUMIDITY C.F.	1.146	1.125	1.125
DRY-TO-WET C.F.	.970	.971	.975
TIME SECONDS	600.0	599.9	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	11.80 (506.6)	11.83 (507.9)	11.83 (507.7)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	118.0 (5066.)	118.3 (5078.)	118.3 (5077.)
HC SAMPLE METER/RANGE/PPM	8.0/ 2/ 8.0	5.0/ 2/ 5.0	5.3/ 2/ 5.3
HC BCKGRD METER/RANGE/PPM	4.1/ 2/ 4.1	4.5/ 2/ 4.5	4.6/ 2/ 4.6
CO SAMPLE METER/RANGE/PPM	25.6/ 12/ 24.8	4.1/ 12/ 3.9	2.5/ 12/ 2.4
CO BCKGRD METER/RANGE/PPM	2.5/ 12/ 2.4	2.2/ 12/ 2.1	2.1/ 12/ 2.0
CO2 SAMPLE METER/RANGE/PCT	75.8/ 11/ .6702	62.9/ 11/ .5122	86.7/ 13/ .2142
CO2 BCKGRD METER/RANGE/PCT	8.3/ 11/ .0556	8.0/ 11/ .0536	21.6/ 13/ .0519
NOX SAMPLE METER/RANGE/PPM	.1/ 1/ .0	.8/ 1/ .2	1.1/ 1/ .3
NOX BCKGRD METER/RANGE/PPM	.0/ 1/ .0	.8/ 1/ .2	1.2/ 1/ .3
DILUTION FACTOR	17.26	22.66	54.08
HC CONCENTRATION PPM	4.14	.70	.78
CO CONCENTRATION PPM	21.69	1.81	.39
CO2 CONCENTRATION PCT	.6179	.4610	.1632
NOX CONCENTRATION PPM	.02	.01	-.02
HC MASS GRAMS	.363	.061	.069
CO MASS GRAMS	3.623	.303	.066
CO2 MASS GRAMS	1621.8	1212.7	429.3
NOX MASS GRAMS	.008	.003	.000
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.544 (1.20)	.405 (.89)	.144 (.32)
KW HR (HP HR)	1.49 (2.00)	.50 (.67)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	5066.1	5077.8	5077.1
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: DFB-2B
FUEL: LPG HD5
ENGINE: B

PROJECT: 08-8778-202
TEST DATE: 06/10/99

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	5100	5081	5079	5041	5066	5078	5077	
Work, hp-hr	1.83	7.17	5.33	3.5	2	0.67	0	2.307
Dilution Factor	15.09	7.44	9.32	12.62	17.26	22.66	54.08	
HC Sample, ppm	7.7	29.7	18.3	16.0	8.0	5.0	5.3	
HC Background, ppm	4.2	4	4.5	4.7	4.1	4.5	4.6	
CH4 Sample, ppm	3.48	5.51	4.24	4.01	3.84	2.97	2.59	
CH4 Background, ppm	2.74	2.29	2.29	2.37	2.29	2.29	2.29	
NMHC Sample, ppm	3.6	23.2	13.3	11.3	3.5	1.5	2.3	
NMHC Background, ppm	1.0	1.3	1.8	1.9	1.4	1.8	1.9	
THC Sample, ppm	7.1	28.7	17.6	15.3	7.3	4.5	4.8	
THC Background, ppm	3.7	3.6	4.1	4.3	3.7	4.1	4.2	
HC Concentration, ppm	3.8	26.2	14.3	11.7	4.1	0.7	0.8	
CH4 Concentration, ppm	0.9	3.5	2.2	1.8	1.7	0.8	0.3	
HMHC Concentration, ppm	2.7	22.1	11.7	9.5	2.2	-0.2	0.4	
THC Mass, gram	0.33	2.31	1.26	1.02	0.36	0.06	0.07	0.58
CH4 Mass, gram	0.09	0.34	0.21	0.17	0.16	0.07	0.03	0.14
NMHC Mass, gram	0.24	1.94	1.03	0.83	0.19	-0.02	0.03	0.43
THC, g/hp-hr	0.18	0.32	0.24	0.29	0.18	0.09		0.25
CH4, g/hp-hr	0.05	0.05	0.04	0.05	0.08	0.11		0.06
NMHC, g/hp-hr	0.13	0.27	0.19	0.24	0.09	-0.03		0.19

Time	600.1	600	599.9	599.9	600	599.9	600	**Total hp**
bhp	0.7	0.9	1.6	6.7	3.3	0.4	0	**13.6**
Wgt. Factor	0.06	0.02	0.05	0.32	0.3	0.1	0.15	
				6/12				

Test No.: DFB-ZB	mg/hr							Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	mg/hp-hr
METHANE	535.94	2028.50	1263.90	1043.78	967.61	445.57	192.57	61.30
ETHANE	124.95	493.07	322.17	317.02	0.00	12.69	14.70	10.18
ETHYLENE	118.01	860.69	470.98	428.36	127.92	4.08	0.15	16.45
PROPANE	625.95	7886.36	4658.10	3374.36	910.54	29.80	81.19	132.08
PROPYLENE	29.47	687.85	303.91	149.34	34.72	2.05	0.00	6.55
ACETYLENE	17.77	16.13	5.32	4.62	0.00	0.00	0.00	0.23
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	22.69	174.49	139.59	81.56	27.78	18.72	8.64	3.63
TRANS-2-BUTENE	0.00	0.00	0.00	2.66	0.00	0.00	0.00	0.06
1-BUTENE	0.00	5.95	2.81	2.20	0.00	0.00	0.00	0.07
2-METHYLPROPENE (ISOBUTYLENE)	0.00	24.44	10.94	6.37	0.00	0.00	0.00	0.23
2.2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	0.00	0.00	0.00	0.00	0.00	2.08	0.00	0.02
1.3-BUTADIENE	0.00	14.73	7.26	2.27	0.00	0.00	0.00	0.10
2-METHYLPROPANE (ISOBUTANE)	0.00	200.90	127.55	87.96	23.92	1.74	1.43	3.39
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	0.00	31.14	43.63	6.24	26.26	28.54	21.90	1.38
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENTANE	0.00	0.00	14.08	0.43	7.75	0.00	0.00	0.23
UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1.3-BUTADIENE	28.91	10.45	0.00	0.00	0.00	16.16	8.84	0.36
TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.3-DIMETHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.3-DIMETHYLBUTANE	5.44	0.00	0.00	0.00	0.00	0.00	0.00	0.02
MTBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	7.16	6.90	8.04	0.27	0.00	0.00	0.00	0.08
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	5.93	4.26	0.00	0.00	0.00	0.00	0.00	0.03
2-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXANE	5.17	0.00	0.00	0.00	0.00	0.00	0.00	0.02
UNIDENTIFIED C6 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ETBE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLPENTANE. NOTE A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOPENTANE. NOTE A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLPENTANE	23.21	0.00	4.08	0.00	0.00	0.00	0.00	0.12
2,2,3-TRIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZENE	6.03	32.46	5.09	5.78	0.00	0.00	0.00	0.23
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	9.91	6.63	10.33	0.30	7.09	7.55	6.77	0.39
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	148.16	1.63
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	24.85	5.11	13.07	0.00	4.95	2.07	3.37	0.33
2-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOHEXANE	0.00	0.00	4.85	0.00	0.00	0.00	0.00	0.02
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	0.00	0.00	4.58	0.00	0.00	0.00	0.00	0.02
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLPENTANE	5.87	0.14	2.90	0.49	0.00	0.00	0.00	0.05
2,3,3-TRIMETHYLPENTANE	0.00	0.00	2.87	0.00	0.00	0.00	0.00	0.01
TOLUENE	0.00	31.28	12.87	1.04	0.16	0.00	0.55	0.13
2,3-DIMETHYLHEXANE	0.00	0.00	4.83	0.00	0.00	0.00	0.00	0.02
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE. NOTE B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.00	4.78	0.00	0.00	0.00	0.00	0.02
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	3.81	0.00	0.03
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	0.00	5.21	0.00	0.00	0.00	8.43	0.00	0.07
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STYRENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
o-XYLENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DECANE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYLBENZENE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

INDAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORMALDEHYDE	0.00	0.00	2.40	3.60	5.40	0.00	0.60	0.22
ACETALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACROLEIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACETONE	0.60	6.00	4.20	42.01	1.80	4.20	0.00	1.09
PROPIONALDEHYDE	0.00	0.60	0.00	31.21	0.00	0.00	0.00	0.74
CROTONALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYRALDEHYDE, NOTE H	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL ETHYL KETONE, NOTE H	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00
BENZALDEHYDE	0.00	22.20	0.00	0.00	24.60	0.00	0.00	0.58
ISOVALERALDEHYDE	0.00	0.00	0.00	0.00	0.00	1.80	37.20	0.42
VALERALDEHYDE	0.00	0.00	0.00	0.00	0.00	8.40	0.00	0.06
O-TOLUALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M/P-TOLUALDEHYDE	0.00	0.00	0.00	0.00	0.00	7.80	0.00	0.06
HEXANALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIMETHYLBENZALDEHYDE	0.00	2.40	0.00	1.20	0.00	1.20	0.00	0.04
SUMMED SPECIATED VALUES	1597.86	12563.89	7455.16	5593.04	2170.50	606.69	526.07	242.68

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-3

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/12/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 2

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	11.	300.	2798.	11.	8.3	79.9	13.9	29.10	1.119	.959	.967	1.032
2	2100.	100.	110.	300.	2098.	110.	17.8	82.3	13.9	29.10	1.119	.959	.958	1.035
3	2100.	75.	82.	300.	2106.	83.	13.9	84.2	14.1	29.10	1.125	.957	.962	1.038
4	2100.	50.	55.	300.	2094.	55.	9.8	84.5	12.8	29.09	1.074	.973	.966	1.036
5	2100.	25.	27.	300.	2098.	28.	6.8	81.9	12.0	29.09	1.044	.983	.970	1.032
6	2100.	10.	11.	300.	2102.	12.	5.3	81.3	12.0	29.08	1.044	.983	.971	1.031
7	800.	0.	0.	300.	784.	0.	1.9	79.5	11.7	29.08	1.035	.986	.976	1.028

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	11.0	1.51	18.3	.1	.00	11223.
2	43.0	20.01	741.0	1.1	.00	22874.
3	33.0	10.60	250.4	.4	.00	18457.
4	21.0	4.18	61.4	.1	.00	13209.
5	11.0	.42	24.5	.0	.00	9158.
6	4.0	.30	6.7	.0	.00	7116.
7	.0	.52	.4	.0	.00	2609.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.50	.09	1.10	.00	.00	673.
2	.020	.9	.36	.40	14.82	.02	.00	457.
3	.050	1.6	.70	.53	12.52	.02	.00	923.
4	.320	6.7	3.14	1.34	19.66	.02	.00	4227.
5	.300	3.3	2.03	.13	7.36	.00	.00	2748.
6	.100	.4	.53	.03	.67	.00	.00	712.
7	.150	.0	.29	.08	.06	.01	.00	391.
TOTAL		13.6	7.5	2.6	56.2	.1	.0	10131.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.01	.08	.00	.000	50.
2	.03	1.09	.00	.000	34.
3	.04	.92	.00	.000	68.
4	.10	1.45	.00	.000	311.
5	.01	.54	.00	.000	202.
6	.00	.05	.00	.000	52.
7	.01	.00	.00	.000	29.

COMPOSITE RESULTS

BSHC ------- =	.19	G/HP-HR	=	.26	G/KW-HR
BSCO ------- =	4.13	G/HP-HR	=	5.54	G/KW-HR
BSNOx ------ =	.01	G/HP-HR	=	.01	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	745.	G/HP-HR	=	1000.	G/KW-HR
BSFC ------- =	.554	LB/HP-HR	=	.337	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS

PROJECT NO. 08-8778-20

DFB-3

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 6/12/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 13 B BAG CART 2

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.5 (29.10)	98.5 (29.10)	98.5 (29.10)	98.5 (29.09)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	24.4 (76.0)/14.0	25.0 (77.0)/13.8	25.6 (78.0)/13.5	25.6 (78.0)/13
ENGINE AIR DEW PT., DEG. C (DEG. F)	18.7 (65.6)	18.7 (65.6)	18.8 (65.9)	17.3 (63.2)
ENGINE AIR TEMP, DEG. C (DEG. F)	26.6 (79.9)	27.9 (82.3)	29.0 (84.2)	29.2 (84.5)
ENGINE AIR: RH,% / AH,G/KG	62./ 13.9	57./ 13.9	54./ 14.1	49./ 12.8
NOx HUMIDITY C.F.	1.119	1.119	1.125	1.074
DRY-TO-WET C.F.	.967	.958	.962	.966
TIME SECONDS	300.0	300.0	299.9	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	11.73 (503.5)	11.70 (502.3)	11.70 (502.0)	11.71 (502.7)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	58.7 (2517.)	58.5 (2511.)	58.5 (2509.)	58.6 (2514.)
HC SAMPLE METER/RANGE/PPM	8.2/ 2/ 8.2	45.2/ 2/ 45.2	27.3/ 2/ 27.3	16.4/ 2/ 16.4
HC BCKGRD METER/RANGE/PPM	5.7/ 2/ 5.7	7.9/ 2/ 7.9	7.8/ 2/ 7.8	9.1/ 2/ 9.1
CO SAMPLE METER/RANGE/PPM	24.0/ 12/ 23.3	43.5/ 2/ 794.8	59.8/ 14/ 271.2	69.5/ 12/ 68.4
CO BCKGRD METER/RANGE/PPM	4.5/ 12/ 4.4	.3/ 2/ 4.1	1.6/ 14/ 6.3	4.3/ 12/ 4.2
CO2 SAMPLE METER/RANGE/PCT	79.0/ 11/ .7840	82.2/ 1/ 1.5275	66.8/ 1/ 1.2473	91.0/ 11/ .9087
CO2 BCKGRD METER/RANGE/PCT	7.6/ 11/ .0717	3.8/ 1/ .0726	3.8/ 1/ .0726	7.3/ 11/ .0689
NOX SAMPLE METER/RANGE/PPM	1.7/ 1/ .4	4.8/ 1/ 1.2	3.2/ 1/ .8	1.6/ 1/ .4
NOX BCKGRD METER/RANGE/PPM	1.7/ 1/ .4	2.9/ 1/ .7	2.5/ 1/ .6	1.6/ 1/ .4
DILUTION FACTOR	14.77	7.23	9.11	12.68
HC CONCENTRATION PPM	2.88	38.37	20.34	8.01
CO CONCENTRATION PPM	18.34	745.78	252.18	61.79
CO2 CONCENTRATION PCT	.7171	1.4650	1.1827	.8453
NOX CONCENTRATION PPM	.03	.58	.24	.03
HC MASS GRAMS	.126	1.667	.883	.349
CO MASS GRAMS	1.522	61.750	20.864	5.120
CO2 MASS GRAMS	935.3	1906.2	1537.6	1100.8
NOX MASS GRAMS	.004	.088	.037	.005
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.313 (.69)	.671 (1.48)	.526 (1.16)	.371 (.82)
KW HR (HP HR)	.68 (.92)	2.67 (3.58)	2.05 (2.75)	1.30 (1.75)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2517.5	2511.4	2509.3	2513.5
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-3

ENGINE NUMBER	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 6/12/98 TIME		HCR 2.67
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R		C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2		ENGINE OIL
			RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.5 (29.09)	98.5 (29.08)	98.5 (29.08)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	25.6 (78.0)/13.5	25.6 (78.0)/14.3	26.1 (79.0)/13.3
ENGINE AIR DEW PT., DEG. C (DEG. F)	16.3 (61.4)	16.3 (61.4)	16.0 (60.8)
ENGINE AIR TEMP, DEG. C (DEG. F)	27.7 (81.9)	27.4 (81.3)	26.4 (79.5)
ENGINE AIR: RH,% / AH,G/KG	50./ 12.0	51./ 12.0	53./ 11.7
NOx HUMIDITY C.F.	1.044	1.044	1.035
DRY-TO-WET C.F.	.970	.971	.976
TIME SECONDS	300.0	300.0	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	11.76 (504.8)	11.78 (505.4)	11.79 (506.1)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	58.8 (2524.)	58.9 (2527.)	59.0 (2530.)
HC SAMPLE METER/RANGE/PPM	7.8/ 2/ 7.8	6.7/ 2/ 6.7	5.9/ 2/ 5.9
HC BCKGRD METER/RANGE/PPM	7.4/ 2/ 7.4	6.4/ 2/ 6.4	5.0/ 2/ 5.0
CO SAMPLE METER/RANGE/PPM	27.5/ 12/ 26.7	8.3/ 12/ 8.1	2.0/ 12/ 1.9
CO BCKGRD METER/RANGE/PPM	1.3/ 12/ 1.3	1.2/ 12/ 1.2	1.6/ 12/ 1.6
CO2 SAMPLE METER/RANGE/PCT	64.4/ 11/ .6335	51.6/ 11/ .5034	89.3/ 13/ .2230
CO2 BCKGRD METER/RANGE/PCT	5.6/ 11/ .0528	5.6/ 11/ .0528	23.7/ 13/ .0583
NOX SAMPLE METER/RANGE/PPM	1.0/ 1/ .3	1.4/ 1/ .4	4.2/ 1/ 1.1
NOX BCKGRD METER/RANGE/PPM	1.2/ 1/ .3	1.4/ 1/ .4	4.2/ 1/ 1.1
DILUTION FACTOR	18.25	23.02	51.93
HC CONCENTRATION PPM	.81	.58	1.00
CO CONCENTRATION PPM	24.56	6.69	.40
CO2 CONCENTRATION PCT	.5836	.4529	.1658
NOX CONCENTRATION PPM	-.03	.02	.02
HC MASS GRAMS	.035	.025	.044
CO MASS GRAMS	2.044	.557	.033
CO2 MASS GRAMS	763.2	593.0	217.4
NOX MASS GRAMS	.000	.002	.003
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.256 (.56)	.198 (.44)	.073 (.16)
KW HR (HP HR)	.68 (.92)	.25 (.33)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	2523.9	2527.2	2530.3
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

APPENDIX D

ENGINE E DEVELOPMENTAL EMISSION RESULTS

- 5-MODE-4

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST 5-MODE-4 RUN
DATE 7/24/98 TIME
COMPUTER PROGRAM SSDIL 1.3 -R
CELL 2 BAG CART 2

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50
Air Inj @ WOT

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	1800.	100.	83.	600.	1798.	83.	24.8	76.0	12.0	29.18	1.043	.984	.973	1.020
2	1800.	75.	62.	600.	1800.	65.	16.1	77.0	12.4	29.18	1.057	.979	.975	1.022
3	1800.	50.	41.	600.	1800.	43.	11.9	77.0	12.5	29.18	1.062	.977	.975	1.023
4	1800.	25.	21.	600.	1798.	23.	9.0	76.0	12.4	29.18	1.057	.979	.976	1.021
5	1800.	10.	8.	600.	1794.	8.	7.3	75.0	12.0	29.17	1.044	.983	.978	1.019

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	28.3	14.30	5083.7	.0	.00	26458.
2	22.1	2.10	174.6	25.2	.00	22121.
3	14.8	1.66	61.8	40.0	.00	16472.
4	7.7	2.80	173.8	5.1	.00	12271.
5	2.6	8.70	268.3	.5	.00	9655.

WEIGHTED RESULTS

MODE	WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.050	1.4	1.24	.72	254.18	.00	.00	1323.
2	.250	5.5	4.03	.52	43.65	6.29	.00	5530.
3	.300	4.4	3.57	.50	18.55	11.99	.00	4942.
4	.300	2.3	2.71	.84	52.14	1.52	.00	3681.
5	.100	.3	.73	.87	26.83	.05	.00	966.
TOTAL		13.9	12.3	3.4	395.3	19.9	.0	16442.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.05	18.23	.00	.000	95.
2	.04	3.13	.45	.000	397.
3	.04	1.33	.86	.000	354.
4	.06	3.74	.11	.000	264.
5	.06	1.92	.00	.000	69.

COMPOSITE RESULTS

BSHC ------- =	.25	G/HP-HR	=	.33	G/KW-HR
BSCO ------- =	28.36	G/HP-HR	=	38.03	G/KW-HR
BSNOx ------ =	1.42	G/HP-HR	=	1.91	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	1179.	G/HP-HR	=	1582.	G/KW-HR
BSFC ------- =	.881	LB/HP-HR	=	.536	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER	TEST 5-MODE-4 RUN	PHASE II EM-2491-F	
ENGINE MODEL	DATE 7/24/98 TIME	HCR 2.03	
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.837 H:.142 O:.020 X:.000	
ENGINE CYCLE OTTO	CELL 2 BAG CART 2	ENGINE OIL 20W50	
		Air Inj @ WOT	

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.8 (29.18)	98.8 (29.18)	98.8 (29.18)	98.8 (29.18)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	29.4 (85.0)/13.4	29.4 (85.0)/12.6	29.4 (85.0)/13.4	30.0 (86.0)/13.
ENGINE AIR DEW PT., DEG. C (DEG. F)	16.3 (61.4)	16.8 (62.3)	17.0 (62.6)	16.8 (62.3)
ENGINE AIR TEMP, DEG. C (DEG. F)	24.4 (76.0)	25.0 (77.0)	25.0 (77.0)	24.4 (76.0)
ENGINE AIR: RH,% / AH,G/KG	61./ 12.0	61./ 12.4	61./ 12.5	63./ 12.4
NOx HUMIDITY C.F.	1.043	1.057	1.062	1.057
DRY-TO-WET C.F.	.973	.975	.975	.976
TIME SECONDS	600.0	600.0	600.0	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	35.02 (1503.2)	35.07 (1505.2)	34.98 (1501.1)	35.02 (1503.1)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	350.2 (15032.)	350.7 (15052.)	349.8 (15011.)	350.2 (15031.)
HC SAMPLE METER/RANGE/PPM	15.3/ 2/ 15.3	8.0/ 2/ 8.0	7.2/ 2/ 7.2	7.5/ 2/ 7.5
HC BCKGRD METER/RANGE/PPM	6.3/ 2/ 6.3	6.9/ 2/ 6.9	6.3/ 2/ 6.3	5.8/ 2/ 5.8
CO SAMPLE METER/RANGE/PPM	74.4/ 2/ 1759.8	62.0/ 12/ 60.8	22.4/ 12/ 21.7	61.1/ 12/ 59.9
CO BCKGRD METER/RANGE/PPM	.0/ 2/ .0	.7/ 12/ .7	.4/ 12/ .4	.2/ 12/ .2
CO2 SAMPLE METER/RANGE/PCT	61.8/ 11/ .6070	52.6/ 11/ .5135	40.8/ 11/ .3950	61.1/ 12/ .3034
CO2 BCKGRD METER/RANGE/PCT	4.6/ 11/ .0433	4.5/ 11/ .0424	4.6/ 11/ .0433	8.5/ 12/ .0418
NOX SAMPLE METER/RANGE/PPM	.4/ 1/ .1	20.3/ 1/ 5.1	31.4/ 1/ 7.9	4.7/ 1/ 1.2
NOX BCKGRD METER/RANGE/PPM	.5/ 1/ .1	.9/ 1/ .2	.6/ 1/ .2	.8/ 1/ .2
DILUTION FACTOR	16.78	25.14	32.87	42.18
HC CONCENTRATION PPM	9.39	1.38	1.09	1.84
CO CONCENTRATION PPM	1709.62	58.64	20.82	58.45
CO2 CONCENTRATION PCT	.5662	.4728	.3530	.2626
NOX CONCENTRATION PPM	-.02	4.87	7.72	.98
HC MASS GRAMS	2.384	.350	.277	.467
CO MASS GRAMS	847.281	29.098	10.303	28.968
CO2 MASS GRAMS	4409.7	3686.9	2745.3	2045.2
NOX MASS GRAMS	.000	4.194	6.663	.845
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	1.875 (4.13)	1.218 (2.68)	.901 (1.99)	.682 (1.50)
KW HR (HP HR)	3.51 (4.71)	2.74 (3.68)	1.84 (2.47)	.95 (1.28)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	15031.7	15051.5	15010.6	15031.2
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER	TEST 5-MODE-4 RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 7/24/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.3 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 2 BAG CART 2	ENGINE OIL 20W50
		Air Inj @ WOT

MODE NUMBER	5
BAROMETER, kPa (IN HG)	98.8 (29.17)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	29.4 (85.0)/12.6
ENGINE AIR DEW PT., DEG. C (DEG. F)	16.4 (61.5)
ENGINE AIR TEMP, DEG. C (DEG. F)	23.9 (75.0)
ENGINE AIR: RH,% / AH,G/KG	63./ 12.0
NOx HUMIDITY C.F.	1.044
DRY-TO-WET C.F.	.978
TIME SECONDS	600.0
TOT. BLOWER RATE, SCMM (SCFM)*	34.97 (1500.9)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	349.7 (15009.)
HC SAMPLE METER/RANGE/PPM	11.1/ 2/ 11.1
HC BCKGRD METER/RANGE/PPM	5.5/ 2/ 5.5
CO SAMPLE METER/RANGE/PPM	93.5/ 12/ 92.8
CO BCKGRD METER/RANGE/PPM	.6/ 12/ .6
CO2 SAMPLE METER/RANGE/PCT	50.0/ 12/ .2474
CO2 BCKGRD METER/RANGE/PCT	8.4/ 12/ .0413
NOX SAMPLE METER/RANGE/PPM	.8/ 1/ .2
NOX BCKGRD METER/RANGE/PPM	.4/ 1/ .1
DILUTION FACTOR	50.76
HC CONCENTRATION PPM	5.72
CO CONCENTRATION PPM	90.36
CO2 CONCENTRATION PCT	.2069
NOX CONCENTRATION PPM	.10
HC MASS GRAMS	1.449
CO MASS GRAMS	44.713
CO2 MASS GRAMS	1609.2
NOX MASS GRAMS	.087
PART MASS GRAMS	.000
FUEL KG (LB)	.549 (1.21)
KW HR (HP HR)	.32 (.43)
FILTER NUMBER	
WEIGHT GAIN (mg)	.000
SAMPLE MULTIPLIER	.000
BLOWER 1 SCF	15008.7
BLOWER 2 SCF	.0
GAS METER 1 SCF	.000
GAS METER 2 SCF	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: 5-MODE-4
FUEL: CARB PHASE II
ENGINE: E

PROJECT: 08-8778-202
TEST DATE: 07/24/98

Mode	1	2	3	4	5	WEIGHTED TOTAL
Modal Weight Factor	0.05	0.25	0.30	0.30	0.10	
Total Flow, std. cu. ft.	15032	15052	15011	15031	15009	
Work, hp-hr	4.71	3.68	2.47	1.28	0.43	2.324
Dilution Factor	16.78	25.14	32.87	42.18	50.76	
HC Sample, ppm	15.3	8.0	7.2	7.5	11.1	
HC Background, ppm	6.3	6.9	6.3	5.8	5.5	
CH4 Sample, ppm	7.9	3.09	2.85	2.77	2.99	
CH4 Background, ppm	2.48	2.48	2.48	2.48	2.48	
NMHC Sample, ppm	5.9	4.3	3.8	4.2	7.5	
NMHC Background, ppm	3.3	3.9	3.3	2.8	2.5	
THC Sample, ppm	13.8	7.4	6.6	7.0	10.5	
THC Background, ppm	5.8	6.4	5.8	5.3	5.0	
HC Concentration, ppm	9.38	1.37	1.09	1.84	5.71	
CH4 Concentration, ppm	5.57	0.71	0.45	0.35	0.56	
HMHC Concentration, ppm	2.72	0.53	0.56	1.42	5.04	
HC Mass, gram	2.380	0.349	0.277	0.466	1.447	0.574
CH4 Mass, gram	1.580	0.201	0.126	0.099	0.158	0.213
NMHC Mass, gram	0.691	0.134	0.142	0.361	1.278	0.347
HC, g/hp-hr	0.51	0.09	0.11	0.36	3.37	0.25
CH4, g/hp-hr	0.34	0.05	0.05	0.08	0.37	0.09
NMHC, g/hp-hr	0.15	0.04	0.06	0.28	2.97	0.15

Time	600	600	600	600	600	**Total hp**
bhp	1.4	5.5	4.4	2.3	0.3	**13.9**
Wgt. Factor	0.05	0.25	0.3	0.3	0.1	

Test No.: 5-Mode-4	mg/hr					Weighted
	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	mg/hp-hr
METHANE	9496.94	1221.46	755.72	606.56	949.74	92.36
ETHANE	185.61	30.11	42.10	95.94	181.01	5.49
ETHYLENE	838.61	95.53	44.59	139.30	314.63	10.97
PROPANE	0.00	0.00	0.00	0.00	0.00	0.00
PROPYLENE	241.11	21.67	10.50	34.31	86.34	2.85
ACETYLENE	85.82	31.75	6.11	0.00	0.00	1.01
PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00
BUTANE	36.72	0.00	7.36	7.01	89.66	1.09
TRANS-2-BUTENE	5.81	0.00	0.00	0.00	5.57	0.06
1-BUTENE	13.73	0.00	0.00	0.00	0.00	0.05
2-METHYLPROPENE (ISOBUTYLENE)	117.70	19.36	10.21	32.64	225.51	3.32
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00
PROPYNE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-BUTADIENE	16.17	0.00	0.00	0.00	0.00	0.06
2-METHYLPROPANE (ISOBUTANE)	15.53	0.00	3.62	5.07	22.19	0.40
1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
METHANOL	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTANE (ISOPENTANE)	183.62	188.44	23.95	9.52	510.71	8.45
2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
PENTANE	90.44	11.72	3.05	0.00	93.83	1.28
UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-1,3-BUTADIENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-PENTENE	15.53	7.12	0.00	0.00	6.49	0.23
3,3-DIMETHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-BUTENE	32.73	14.09	2.54	1.84	0.53	0.47
TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTADIENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLBUTANE	0.00	7.22	2.18	0.00	5.05	0.21
CYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLBUTANE	12.80	8.56	0.00	0.00	77.96	0.76
MTBE	168.13	67.75	15.98	0.00	0.00	2.17
4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLPENTANE	34.44	22.59	1.80	1.76	182.58	1.92
4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLPENTANE	0.00	16.07	0.00	0.00	149.99	1.37
2-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
HEXANE	10.74	4.36	3.80	0.00	49.57	0.56
UNIDENTIFIED C6 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00

ETBE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLPENTANE, NOTE A	3.17	0.07	0.00	0.00	18.77	0.15
METHYLCYCLOPENTANE, NOTE A	3.10	0.07	0.00	0.00	18.39	0.14
2,4-DIMETHYLPENTANE	23.00	13.79	6.89	1.26	147.11	1.56
2,2,3-TRIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
BENZENE	1939.34	172.69	43.81	296.28	879.24	23.75
3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXANE	0.00	0.00	0.00	13.98	0.00	0.30
2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLPENTANE	50.22	25.97	4.38	2.45	400.16	3.67
1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
CYCLOHEXENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLHEXANE	10.06	9.11	1.64	0.92	82.53	0.85
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLPENTANE	0.00	0.00	0.00	0.00	19.99	0.14
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	14.37	0.10
1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLPENTANE	73.96	90.08	0.00	0.00	565.51	5.95
2-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
HEPTANE	13.64	1.52	9.01	0.00	62.29	0.72
CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C7	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYL-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
METHYLCYCLOHEXANE	3.28	0.00	0.00	0.00	19.38	0.15
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,3-TRIMETHYLPENTANE	0.00	0.00	0.00	20.22	54.32	0.83
2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEXANE	0.00	0.00	38.69	22.21	77.62	1.87
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	15.11	0.11
3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3,4-TRIMETHYLPENTANE	10.47	16.28	0.00	0.00	151.41	1.42
2,3,3-TRIMETHYLPENTANE	4.55	4.83	0.00	0.00	91.09	0.76
TOLUENE	403.31	85.54	37.07	55.09	254.52	6.81
2,3-DIMETHYLHEXANE	0.00	24.35	0.00	0.00	72.99	0.96
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEXANE, NOTE B	0.00	0.00	0.00	0.00	0.00	0.00
4-METHYLHEPTANE	0.00	0.00	0.00	0.00	153.75	1.11
3-METHYLHEPTANE	0.00	0.00	0.00	0.00	85.93	0.62
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
3-ETHYLHEXANE	5.02	4.08	0.27	0.00	0.00	0.10
2,2,5-TRIMETHYLHEXANE	7.35	5.17	1.08	0.00	44.80	0.46

TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	12.59	0.09
1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
1-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
OCTANE	1.53	3.97	1.23	0.00	14.90	0.21
UNIDENTIFIED C8	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.00	0.00	0.00	0.00	0.00
CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
4,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.00	0.00	0.00	0.00	0.00
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	12.19	0.09
3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.00	0.00	0.00	0.00	0.00
ETHYLBENZENE	21.51	11.37	0.00	0.00	29.58	0.49
2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
m-& p-XYLENE	103.96	20.47	0.00	8.80	152.73	2.03
4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
3-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
STYRENE	0.00	0.00	0.00	0.00	0.00	0.00
o-XYLENE	52.51	13.46	0.00	0.00	78.07	0.99
1-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
NONANE	0.00	0.00	0.00	0.00	0.00	0.00
TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
ISOPROPYLBENZENE (CUMENE)	0.00	0.00	0.00	0.00	0.00	0.00
2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
2,4-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
n-PROPYLBENZENE	0.00	0.00	0.00	37.62	0.00	0.81
1-METHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	37.80	0.27
1,2,4-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00
DECANE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00
ISOBUTYLBENZENE, NOTE F	0.00	0.00	0.00	0.00	0.00	0.00
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00

INDAN	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.00	0.00	0.00	0.00	0.00
1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1-METHYL-2-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
UNDECANE	0.00	0.00	42.10	0.00	0.00	0.91
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
2-METHYLBUTYLBENZENE (sec AMYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
N-PENT-BENZENE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
NAPHTHALENE	0.00	0.00	0.00	0.00	0.00	0.00
DODECANE	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
UNIDENTIFIED C9-C12+	0.00	0.00	0.00	0.00	0.00	0.00
FORMALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00
ACETALDEHYDE	48.00	48.00	16.20	14.40	45.00	2.02
ACROLEIN	0.00	13.80	0.00	16.20	15.00	0.71
ACETONE	0.60	17.40	0.00	0.00	22.80	0.48
PROPIONALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00
CROTONALDEHYDE	36.60	25.80	26.40	33.00	0.00	1.88
ISOBUTYRALDEHYDE, NOTE H	13.20	6.00	15.00	25.20	7.80	1.08
METHYL ETHYL KETONE, NOTE H	13.20	6.00	15.00	25.20	7.80	1.08
BENZALDEHYDE	0.00	0.00	0.00	52.20	0.00	1.13
ISOVALERALDEHYDE	0.00	0.00	0.00	25.20	0.00	0.54
VALERALDEHYDE	63.60	102.00	128.40	63.00	24.60	6.37
O-TOLUALDEHYDE	0.00	137.40	0.00	0.00	0.00	2.47
M/P-TOLUALDEHYDE	10.20	152.40	0.00	0.60	0.00	2.79
HEXANALDEHYDE	0.00	0.00	0.00	0.00	0.00	0.00
DIMETHYLBENZALDEHYDE	0.00	43.20	49.20	0.00	44.40	2.16
SUMMED SPECIATED VALUES	14517.53	2822.64	1369.86	1647.79	6685.89	216.22

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.

B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.

C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.

D - Propylcyclopentane co-elutes with reported compound. Not reported separately.

E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.

F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.

G - n-Butylbenzene co-elutes with reported compound. Not reported separately.

H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

APPENDIX E

ENGINE B 250-HOUR DURABILITY RESULTS

- DFB-4
- DFB-5
- DFB-6

ENGINE E 250-HOUR DURABILITY RESULTS

- 5-MODE-5
- 5-MODE-6

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-4

ENGINE NUMBER B
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 10/19/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 13 B BAG CART 2

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	300.	2798.	23.	8.1	71.1	9.9	29.28	.975	1.010	.973	1.007
2	2100.	100.	109.	300.	2092.	109.	17.7	69.7	8.1	29.28	.922	1.036	.963	1.002
3	2100.	75.	81.	300.	2098.	82.	13.7	71.3	7.8	29.28	.912	1.040	.969	1.004
4	2100.	50.	54.	300.	2096.	54.	10.5	69.3	7.2	29.28	.896	1.049	.972	1.000
5	2100.	25.	27.	300.	2106.	27.	6.9	71.4	9.2	29.29	.953	1.020	.975	1.006
6	2100.	10.	11.	300.	2104.	11.	5.1	71.1	9.5	29.28	.961	1.017	.977	1.006
7	800.	0.	0.	300.	808.	0.	2.0	70.0	9.6	29.29	.964	1.015	.981	1.005

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	12.0	.60	.4	102.0	.00	10928.
2	43.0	9.37	430.5	45.7	.00	23279.
3	32.0	.30	1.8	90.9	.00	18545.
4	22.0	3.68	.3	286.4	.00	14273.
5	11.0	.64	.4	68.4	.00	9302.
6	4.0	.35	.2	10.2	.00	6924.
7	.0	6.89	.1	.5	.00	2633.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.48	.04	.02	6.12	.00	656.
2	.020	.9	.35	.19	8.61	.91	.00	466.
3	.050	1.6	.68	.01	.09	4.55	.00	927.
4	.320	7.0	3.37	1.18	.11	91.66	.00	4567.
5	.300	3.3	2.06	.19	.12	20.51	.00	2791.
6	.100	.4	.51	.03	.02	1.02	.00	692.
7	.150	.0	.29	1.03	.02	.07	.00	395.
TOTAL		13.9	7.7	2.7	9.0	124.8	.0	10494.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.00	.00	.44	.000	47.
2	.01	.62	.07	.000	33.
3	.00	.01	.33	.000	67.
4	.08	.01	6.59	.000	328.
5	.01	.01	1.47	.000	201.
6	.00	.00	.07	.000	50.
7	.07	.00	.01	.000	28.

COMPOSITE RESULTS

BSHC ------- =	.19	G/HP-HR	=	.26	G/KW-HR
BSCO ------- =	.65	G/HP-HR	=	.87	G/KW-HR
BSNOx ------ =	8.97	G/HP-HR	=	12.03	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	754.	G/HP-HR	=	1011.	G/KW-HR
BSFC ------- =	.557	LB/HP-HR	=	.339	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB4

ENGINE NUMBER B
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN LPG LPG
DATE 10/19/96 TIME HCR 2.67
COMPUTER PROGRAM SSDIL 1.5 -R C:.817 H:.183 O:.000 X:.000
CELL 13 B BAG CART 2 ENGINE OIL
RANGER CATALYST

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	99.1 (29.28)	99.1 (29.28)	99.1 (29.28)	99.1 (29.28)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/10.7	23.3 (74.0)/10.7	23.9 (75.0)/ 9.7	23.3 (74.0)/10.(
ENGINE AIR DEW PT., DEG. C (DEG. F)	13.6 (56.4)	10.6 (51.0)	9.9 (49.9)	8.7 (47.7)
ENGINE AIR TEMP, DEG. C (DEG. F)	21.7 (71.1)	20.9 (69.7)	21.8 (71.3)	20.7 (69.3)
ENGINE AIR: RH,% / AH,G/KG	60./ 9.9	51./ 8.1	47./ 7.8	46./ 7.2
NOx HUMIDITY C.F.	.975	.922	.912	.896
DRY-TO-WET C.F.	.973	.963	.969	.972
TIME SECONDS	299.9	300.0	300.1	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.77 (521.8)	13.78 (522.0)	13.77 (521.8)	13.70 (519.2)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.8 (2608.)	68.9 (2610.)	68.9 (2610.)	68.5 (2596.)
HC SAMPLE METER/RANGE/PPM	5.7/ 2/ 5.7	21.6/ 2/ 21.6	5.4/ 2/ 5.4	11.5/ 2/ 11.5
HC BCKGRD METER/RANGE/PPM	4.9/ 2/ 4.9	5.0/ 2/ 5.0	5.4/ 2/ 5.4	5.1/ 2/ 5.1
CO SAMPLE METER/RANGE/PPM	.4/ 12/ .4	89.7/ 14/ 441.0	3.2/ 12/ 3.1	1.2/ 12/ 1.2
CO BCKGRD METER/RANGE/PPM	.0/ 12/ .0	.2/ 14/ .8	1.4/ 12/ 1.4	.9/ 12/ .9
CO2 SAMPLE METER/RANGE/PCT	72.7/ 11/ .7188	79.5/ 1/ 1.4778	63.5/ 1/ 1.1878	92.7/ 11/ .9265
CO2 BCKGRD METER/RANGE/PCT	5.1/ 11/ .0481	2.6/ 1/ .0496	2.6/ 1/ .0496	2.4/ 1/ .0458
NOX SAMPLE METER/RANGE/PPM	61.9/ 2/ 62.0	29.5/ 2/ 29.6	59.1/ 2/ 59.2	75.8/ 3/ 190.0
NOX BCKGRD METER/RANGE/PPM	.3/ 2/ .3	.4/ 2/ .4	.5/ 2/ .5	.2/ 3/ .5
DILUTION FACTOR	16.16	7.64	9.78	12.53
HC CONCENTRATION PPM	1.11	17.28	.55	6.82
CO CONCENTRATION PPM	.37	416.88	1.77	.33
CO2 CONCENTRATION PCT	.6737	1.4346	1.1433	.8844
NOX CONCENTRATION PPM	61.74	29.21	58.76	189.56
HC MASS GRAMS	.050	.781	.025	.306
CO MASS GRAMS	.032	35.873	.152	.028
CO2 MASS GRAMS	910.4	1940.0	1545.9	1189.4
NOX MASS GRAMS	8.501	3.805	7.579	23.870
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.304 (.67)	.668 (1.47)	.517 (1.14)	.398 (.88)
KW HR (HP HR)	.75 (1.00)	2.67 (3.58)	1.99 (2.67)	1.37 (1.83)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2607.9	2609.9	2609.8	2595.9
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-4

ENGINE NUMBER B	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 10/19/98 TIME		HCR 2.67
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R		C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2		ENGINE OIL
			RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	99.2 (29.29)	99.2 (29.28)	99.2 (29.29)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	22.8 (73.0)/10.2	22.8 (73.0)/10.2	22.8 (73.0)/10.2
ENGINE AIR DEW PT., DEG. C (DEG. F)	12.4 (54.4)	12.8 (55.1)	13.0 (55.4)
ENGINE AIR TEMP, DEG. C (DEG. F)	21.9 (71.4)	21.7 (71.1)	21.1 (70.0)
ENGINE AIR: RH,% / AH,G/KG	55./ 9.2	57./ 9.5	60./ 9.6
NOx HUMIDITY C.F.	.953	.961	.964
DRY-TO-WET C.F.	.975	.977	.981
TIME SECONDS	299.9	299.9	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.74 (520.6)	13.74 (520.5)	13.74 (520.5)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.7 (2602.)	68.7 (2602.)	68.7 (2603.)
HC SAMPLE METER/RANGE/PPM	6.2/ 2/ 6.2	6.4/ 2/ 6.4	19.8/ 2/ 19.8
HC BCKGRD METER/RANGE/PPM	5.3/ 2/ 5.3	6.0/ 2/ 6.0	7.2/ 2/ 7.2
CO SAMPLE METER/RANGE/PPM	1.1/ 12/ 1.1	.3/ 12/ .3	.5/ 12/ .5
CO BCKGRD METER/RANGE/PPM	.7/ 12/ .7	.1/ 12/ .1	.4/ 12/ .4
CO2 SAMPLE METER/RANGE/PCT	63.1/ 11/ .6202	48.6/ 11/ .4731	83.0/ 13/ .2072
CO2 BCKGRD METER/RANGE/PCT	5.1/ 11/ .0481	5.0/ 11/ .0471	18.3/ 13/ .0453
NOX SAMPLE METER/RANGE/PPM	42.6/ 2/ 42.7	26.0/ 1/ 6.6	1.4/ 1/ .4
NOX BCKGRD METER/RANGE/PPM	.3/ 2/ .3	1.1/ 1/ .3	.3/ 1/ .1
DILUTION FACTOR	18.72	24.53	55.54
HC CONCENTRATION PPM	1.19	.65	12.75
CO CONCENTRATION PPM	.40	.19	.10
CO2 CONCENTRATION PCT	.5748	.4279	.1627
NOX CONCENTRATION PPM	42.40	6.29	.29
HC MASS GRAMS	.053	.029	.574
CO MASS GRAMS	.034	.016	.009
CO2 MASS GRAMS	774.9	576.8	219.4
NOX MASS GRAMS	5.696	.851	.039
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.259 (.57)	.193 (.42)	.074 (.16)
KW HR (HP HR)	.68 (.92)	.25 (.33)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	2602.3	2601.6	2602.7
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-20

DFB-5

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 10/19/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 13 B BAG CART 2

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	300.	2808.	23.	8.5	69.0	9.0	29.23	.947	1.023	.970	1.005
2	2100.	100.	108.	300.	2106.	108.	18.0	69.0	8.9	29.23	.945	1.024	.963	1.004
3	2100.	75.	81.	300.	2102.	81.	13.8	70.4	8.8	29.22	.941	1.026	.966	1.006
4	2100.	50.	54.	300.	2102.	54.	10.4	70.3	8.8	29.23	.940	1.026	.971	1.006
5	2100.	25.	27.	300.	2094.	27.	7.0	70.0	8.6	29.22	.934	1.029	.973	1.005
6	2100.	10.	11.	300.	2096.	11.	5.3	69.3	8.8	29.22	.940	1.026	.975	1.005
7	800.	0.	0.	300.	788.	0.	1.9	70.8	10.7	29.22	.999	1.001	.979	1.010

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	12.0	.57	1.5	47.3	.00	11484.
2	44.0	7.90	474.0	41.4	.00	23646.
3	32.0	2.17	134.8	11.2	.00	18487.
4	22.0	1.96	83.1	9.2	.00	13924.
5	11.0	.27	6.5	.5	.00	9466.
6	4.0	.58	34.5	.0	.00	7118.
7	.0	.47	4.6	.0	.00	2542.

WEIGHTED RESULTS

MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
.060	.7	.51	.03	.09	2.84	.00	689.
.020	.9	.36	.16	9.48	.83	.00	473.
.050	1.6	.69	.11	6.74	.56	.00	924.
.320	7.0	3.31	.63	26.59	2.95	.00	4456.
.300	3.3	2.09	.08	1.94	.15	.00	2840.
.100	.4	.53	.06	3.45	.00	.00	712.
.150	.0	.28	.07	.69	.00	.00	381.
TOTAL	13.9	7.8	1.1	49.0	7.3	.0	10475.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.00	.01	.20	.000	49.
2	.01	.68	.06	.000	34.
3	.01	.48	.04	.000	66.
4	.05	1.91	.21	.000	320.
5	.01	.14	.01	.000	204.
6	.00	.25	.00	.000	51.
7	.01	.05	.00	.000	27.

COMPOSITE RESULTS

BSHC ------- =	.08	G/HP-HR	=	.11	G/KW-HR
BSCO ------- =	3.51	G/HP-HR	=	4.71	G/KW-HR
BSNOx ------ =	.53	G/HP-HR	=	.70	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	751.	G/HP-HR	=	1008.	G/KW-HR
BSFC ------- =	.558	LB/HP-HR	=	.339	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-5

ENGINE NUMBER	TEST	RUN	LPG	LPG
ENGINE MODEL	DATE 10/19/98	TIME	HCR 2.67	
ENGINE	COMPUTER PROGRAM	SSDIL 1.5 -R	C:.817 H:.183 O:.000 X:.000	
ENGINE CYCLE OTTO	CELL 13 B	BAG CART 2	ENGINE OIL	
			RANGER CATALYST	

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	99.0 (29.23)	99.0 (29.23)	98.9 (29.22)	99.0 (29.23)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/12.1	23.3 (74.0)/10.7	23.9 (75.0)/11.2	22.8 (73.0)/10.9
ENGINE AIR DEW PT., DEG. C (DEG. F)	12.1 (53.7)	11.9 (53.5)	11.7 (53.1)	11.7 (53.0)
ENGINE AIR TEMP, DEG. C (DEG. F)	20.6 (69.0)	20.6 (69.0)	21.3 (70.4)	21.3 (70.3)
ENGINE AIR: RH,% / AH,G/KG	58./ 9.0	58./ 8.9	54./ 8.8	54./ 8.8
NOx HUMIDITY C.F.	.947	.945	.941	.940
DRY-TO-WET C.F.	.970	.963	.966	.971
TIME SECONDS	300.0	299.9	300.0	300.1
TOT. BLOWER RATE, SCMM (SCFM)*	13.69 (518.7)	13.74 (520.7)	13.72 (520.0)	13.71 (519.5)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.4 (2594.)	68.7 (2602.)	68.6 (2600.)	68.6 (2598.)
HC SAMPLE METER/RANGE/PPM	4.6/ 2/ 4.6	17.7/ 2/ 17.7	8.4/ 2/ 8.4	7.5/ 2/ 7.5
HC BCKGRD METER/RANGE/PPM	3.8/ 2/ 3.8	3.6/ 2/ 3.6	4.9/ 2/ 4.9	4.2/ 2/ 4.2
CO SAMPLE METER/RANGE/PPM	4.1/ 12/ 4.0	97.0/ 14/ 487.2	59.5/ 13/ 138.1	37.5/ 13/ 84.7
CO BCKGRD METER/RANGE/PPM	2.7/ 12/ 2.6	.2/ 14/ .8	.3/ 13/ .7	.2/ 13/ .4
CO2 SAMPLE METER/RANGE/PCT	77.6/ 11/ .7695	81.1/ 1/ 1.5072	63.8/ 1/ 1.1932	90.7/ 11/ .9056
CO2 BCKGRD METER/RANGE/PCT	6.5/ 11/ .0613	2.8/ 1/ .0534	2.9/ 1/ .0553	5.0/ 11/ .0471
NOX SAMPLE METER/RANGE/PPM	30.8/ 2/ 30.9	26.9/ 2/ 27.0	29.3/ 1/ 7.4	24.3/ 1/ 6.1
NOX BCKGRD METER/RANGE/PPM	1.3/ 2/ 1.3	1.2/ 2/ 1.2	1.6/ 1/ .4	1.4/ 1/ .4
DILUTION FACTOR	15.09	7.47	9.63	12.71
HC CONCENTRATION PPM	1.05	14.61	4.02	3.64
CO CONCENTRATION PPM	1.43	460.22	131.08	80.86
CO2 CONCENTRATION PCT	.7122	1.4609	1.1436	.8622
NOX CONCENTRATION PPM	29.64	25.91	7.01	5.81
HC MASS GRAMS	.047	.658	.181	.164
CO MASS GRAMS	.122	39.488	11.237	6.927
CO2 MASS GRAMS	957.0	1969.8	1540.6	1160.7
NOX MASS GRAMS	3.942	3.450	.929	.768
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.320 (.71)	.680 (1.50)	.521 (1.15)	.392 (.86)
KW HR (HP HR)	.75 (1.00)	2.73 (3.66)	1.99 (2.67)	1.37 (1.83)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2593.5	2602.5	2600.1	2598.3
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-20

DF13-5

ENGINE NUMBER	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 10/19/98 TIME		HCR 2.67
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R		C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2		ENGINE OIL
			RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	98.9 (29.22)	98.9 (29.22)	98.9 (29.22)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/11.4	23.3 (74.0)/11.4	23.3 (74.0)/11.4
ENGINE AIR DEW PT., DEG. C (DEG. F)	11.3 (52.4)	11.7 (53.0)	14.6 (58.3)
ENGINE AIR TEMP, DEG. C (DEG. F)	21.1 (70.0)	20.7 (69.3)	21.6 (70.8)
ENGINE AIR: RH,% / AH,G/KG	54./ 8.6	56./ 8.8	65./ 10.7
NOx HUMIDITY C.F.	.934	.940	.999
DRY-TO-WET C.F.	.973	.975	.979
TIME SECONDS	300.0	300.1	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.74 (520.6)	13.72 (520.0)	13.72 (520.0)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.7 (2603.)	68.6 (2601.)	68.6 (2600.)
HC SAMPLE METER/RANGE/PPM	4.1/ 2/ 4.1	4.8/ 2/ 4.8	4.4/ 2/ 4.4
HC BCKGRD METER/RANGE/PPM	3.8/ 2/ 3.8	3.9/ 2/ 3.9	3.6/ 2/ 3.6
CO SAMPLE METER/RANGE/PPM	7.1/ 12/ 6.9	36.2/ 12/ 35.2	4.9/ 12/ 4.8
CO BCKGRD METER/RANGE/PPM	.4/ 12/ .4	.6/ 12/ .6	.2/ 12/ .2
CO2 SAMPLE METER/RANGE/PCT	64.0/ 11/ .6294	50.0/ 11/ .4872	82.0/ 13/ .2047
CO2 BCKGRD METER/RANGE/PCT	5.0/ 11/ .0471	5.2/ 11/ .0490	19.5/ 13/ .0483
NOX SAMPLE METER/RANGE/PPM	.5/ 2/ .5	.4/ 2/ .4	1.5/ 1/ .4
NOX BCKGRD METER/RANGE/PPM	.2/ 2/ .2	.4/ 2/ .4	1.5/ 1/ .4
DILUTION FACTOR	18.43	23.67	56.53
HC CONCENTRATION PPM	.51	1.07	.87
CO CONCENTRATION PPM	6.29	33.54	4.45
CO2 CONCENTRATION PCT	.5849	.4403	.1573
NOX CONCENTRATION PPM	.31	.02	.01
HC MASS GRAMS	.023	.048	.039
CO MASS GRAMS	.540	2.876	.382
CO2 MASS GRAMS	788.8	593.4	211.9
NOX MASS GRAMS	.041	.002	.001
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.264 (.58)	.200 (.44)	.071 (.16)
KW HR (HP HR)	.68 (.92)	.25 (.33)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	2603.0	2601.1	2600.0
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: DFB-5 PROJECT: 08-8778-202
FUEL: LPG HD5 TEST DATE: 10/19/98
ENGINE: B

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	2594	2602	2600	2598	2603	2601	2600	
Work, hp-hr	1	3.66	2.67	1.83	0.92	0.33	0	1.161
Dilution Factor	15.09	7.47	9.63	12.71	18.43	23.67	56.53	
HC Sample, ppm	4.6	17.7	8.4	7.5	4.1	4.8	4.4	
HC Background, ppm	3.8	3.6	4.9	4.2	3.8	3.9	3.6	
CH4 Sample, ppm	2.66	4.12	4.03	3.16	2.29	2.84	2.46	
CH4 Background, ppm	2.04	2.01	3.26	2.29	2.01	2.02	2.01	
NMHC Sample, ppm	1.4	12.8	3.6	3.7	1.4	1.4	1.5	
NMHC Background, ppm	1.4	1.2	1.0	1.5	1.4	1.5	1.2	
THC Sample, ppm	4.1	16.9	7.6	6.9	3.7	4.3	3.9	
THC Background, ppm	3.4	3.2	4.3	3.8	3.4	3.5	3.2	
HC Concentration, ppm	1.1	14.6	4.0	3.6	0.5	1.1	0.9	
CH4 Concentration, ppm	0.8	2.4	1.1	1.1	0.4	0.9	0.5	
HMHC Concentration, ppm	0.2	11.8	2.7	2.4	0.0	-0.0	0.3	
THC Mass, gram	0.05	0.66	0.18	0.16	0.02	0.05	0.04	0.09
CH4 Mass, gram	0.04	0.12	0.05	0.05	0.02	0.04	0.02	0.04
NMHC Mass, gram	0.01	0.53	0.12	0.11	0.00	-0.00	0.01	0.05
THC, g/hp-hr	0.05	0.18	0.07	0.09	0.02	0.15		0.08
CH4, g/hp-hr	0.04	0.03	0.02	0.03	0.02	0.13		0.03
NMHC, g/hp-hr	0.01	0.14	0.05	0.06	0.00	-0.00		0.05

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-6

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST RUN
DATE 10/20/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 13 B BAG CART 2

LPG LPG
HCR 2.67
C:.817 H:.183 O:.000 X:.000
ENGINE OIL
RANGER CATALYST

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	2800.	25.	23.	300.	2796.	23.	8.5	69.0	10.2	29.29	.984	1.007	.971	1.004
2	2100.	100.	108.	304.	2100.	108.	17.7	70.3	10.3	29.29	.987	1.005	.963	1.006
3	2100.	75.	81.	300.	2098.	81.	13.8	71.3	10.3	29.29	.987	1.005	.967	1.008
4	2100.	50.	54.	300.	2106.	54.	10.4	71.8	10.1	29.29	.979	1.008	.970	1.008
5	2100.	25.	27.	300.	2108.	27.	6.9	71.4	10.2	29.29	.984	1.007	.974	1.008
6	2100.	10.	11.	300.	2102.	11.	5.2	71.0	10.1	29.29	.979	1.009	.976	1.007
7	800.	0.	0.	300.	806.	0.	1.9	70.4	9.9	29.29	.975	1.010	.980	1.006

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	12.0	.17	2.3	.7	.00	11576.
2	43.0	11.97	733.1	29.2	.00	22891.
3	32.0	3.64	187.1	10.8	.00	18388.
4	22.0	.93	28.1	2.8	.00	14066.
5	11.0	.39	8.8	.2	.00	9406.
6	4.0	.42	24.6	.1	.00	6976.
7	.0	.26	3.5	.0	.00	2596.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.060	.7	.51	.01	.14	.04	.00	695.
2	.020	.9	.35	.24	14.66	.58	.00	458.
3	.050	1.6	.69	.18	9.36	.54	.00	919.
4	.320	7.0	3.33	.30	9.00	.91	.00	4501.
5	.300	3.3	2.08	.12	2.63	.07	.00	2822.
6	.100	.4	.52	.04	2.46	.01	.00	698.
7	.150	.0	.29	.04	.53	.00	.00	389.
TOTAL		13.9	7.8	.9	38.8	2.1	.0	10482.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.00	.01	.00	.000	50.
2	.02	1.05	.04	.000	33.
3	.01	.67	.04	.000	66.
4	.02	.65	.07	.000	323.
5	.01	.19	.00	.000	203.
6	.00	.18	.00	.000	50.
7	.00	.04	.00	.000	28.

COMPOSITE RESULTS

BSHC ------- =	.07	G/HP-HR	=	.09	G/KW-HR
BSCO ------- =	2.79	G/HP-HR	=	3.74	G/KW-HR
BSNOx ------ =	.15	G/HP-HR	=	.21	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	753.	G/HP-HR	=	1010.	G/KW-HR
BSFC ------- =	.558	LB/HP-HR	=	.339	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-6

ENGINE NUMBER	TEST	RUN	LPG	LPG
ENGINE MODEL	DATE 10/20/98	TIME	HCR 2.67	
ENGINE	COMPUTER PROGRAM	SSDIL 1.5 -R	C:.817 H:.183 O:.000 X:.000	
ENGINE CYCLE OTTO	CELL 13 B	BAG CART 2	ENGINE OIL	
			RANGER CATALYST	

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	99.2 (29.29)	99.2 (29.29)	99.2 (29.29)	99.2 (29.29)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/11.9	23.9 (75.0)/11.1	23.9 (75.0)/11.1	23.3 (74.0)/11.4
ENGINE AIR DEW PT., DEG. C (DEG. F)	14.0 (57.2)	14.1 (57.4)	14.1 (57.4)	13.8 (56.8)
ENGINE AIR TEMP, DEG. C (DEG. F)	20.6 (69.0)	21.3 (70.3)	21.8 (71.3)	22.1 (71.8)
ENGINE AIR: RH,% / AH,G/KG	66./ 10.2	64./ 10.3	62./ 10.3	59./ 10.1
NOx HUMIDITY C.F.	.984	.987	.987	.979
DRY-TO-WET C.F.	.971	.963	.967	.970
TIME SECONDS	300.0	304.0	300.0	300.1
TOT. BLOWER RATE, SCMM (SCFM)*	13.72 (519.8)	13.74 (520.6)	13.72 (519.9)	13.72 (520.1)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.6 (2599.)	69.6 (2638.)	68.6 (2599.)	68.6 (2601.)
HC SAMPLE METER/RANGE/PPM	4.7/ 2/ 4.7	26.1/ 2/ 26.1	10.5/ 2/ 10.5	5.5/ 2/ 5.5
HC BCKGRD METER/RANGE/PPM	4.7/ 2/ 4.7	4.6/ 2/ 4.6	4.2/ 2/ 4.2	4.1/ 2/ 4.1
CO SAMPLE METER/RANGE/PPM	5.1/ 12/ 4.9	77.1/ 1/ 752.3	81.1/ 13/ 193.7	32.3/ 12/ 31.4
CO BCKGRD METER/RANGE/PPM	2.8/ 12/ 2.7	.1/ 1/ .7	1.4/ 13/ 3.1	3.1/ 12/ 3.0
CO2 SAMPLE METER/RANGE/PCT	77.4/ 11/ .7674	78.3/ 1/ 1.4558	63.1/ 1/ 1.1806	91.7/ 11/ .9160
CO2 BCKGRD METER/RANGE/PCT	5.8/ 11/ .0547	2.5/ 1/ .0477	2.5/ 1/ .0477	5.3/ 11/ .0499
NOX SAMPLE METER/RANGE/PPM	3.5/ 1/ .9	71.1/ 1/ 17.8	26.9/ 1/ 6.8	7.5/ 1/ 1.9
NOX BCKGRD METER/RANGE/PPM	1.9/ 1/ .5	1.5/ 1/ .4	1.2/ 1/ .3	.9/ 1/ .2
DILUTION FACTOR	15.13	7.60	9.68	12.64
HC CONCENTRATION PPM	.31	22.14	6.75	1.73
CO CONCENTRATION PPM	2.27	711.83	181.97	27.35
CO2 CONCENTRATION PCT	.7163	1.4143	1.1379	.8701
NOX CONCENTRATION PPM	.44	17.47	6.51	1.71
HC MASS GRAMS	.014	1.011	.303	.078
CO MASS GRAMS	.195	61.910	15.595	2.346
CO2 MASS GRAMS	964.6	1933.0	1532.4	1172.5
NOX MASS GRAMS	.062	2.462	.904	.236
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.322 (.71)	.679 (1.50)	.521 (1.15)	.393 (.87)
KW HR (HP HR)	.75 (1.00)	2.71 (3.63)	1.99 (2.67)	1.37 (1.83)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2599.2	2637.9	2599.3	2601.2
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO C2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

DFB-6

ENGINE NUMBER	TEST	RUN	LPG LPG
ENGINE MODEL	DATE 10/20/98	TIME	HCR 2.67
ENGINE	COMPUTER PROGRAM	SSDIL 1.5 -R	C:.817 H:.183 O:.000 X:.000
ENGINE CYCLE OTTO	CELL 13 B	BAG CART 2	ENGINE OIL
			RANGER CATALYST

MODE NUMBER	5	6	7
BAROMETER, kPa (IN HG)	99.2 (29.29)	99.2 (29.29)	99.2 (29.29)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/11.4	23.9 (75.0)/11.1	23.9 (75.0)/11.1
ENGINE AIR DEW PT., DEG. C (DEG. F)	14.0 (57.2)	13.8 (56.8)	13.6 (56.4)
ENGINE AIR TEMP, DEG. C (DEG. F)	21.9 (71.4)	21.7 (71.0)	21.3 (70.4)
ENGINE AIR: RH,% / AH,G/KG	61./ 10.2	61./ 10.1	61./ 9.9
NOx HUMIDITY C.F.	.984	.979	.975
DRY-TO-WET C.F.	.974	.976	.980
TIME SECONDS	300.0	299.9	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.74 (520.6)	13.76 (521.4)	13.74 (520.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.7 (2603.)	68.8 (2606.)	68.7 (2604.)
HC SAMPLE METER/RANGE/PPM	4.6/ 2/ 4.6	4.8/ 2/ 4.8	4.5/ 2/ 4.5
HC BCKGRD METER/RANGE/PPM	4.1/ 2/ 4.1	4.2/ 2/ 4.2	4.1/ 2/ 4.1
CO SAMPLE METER/RANGE/PPM	11.7/ 12/ 11.3	27.9/ 12/ 27.1	4.2/ 12/ 4.1
CO BCKGRD METER/RANGE/PPM	2.7/ 12/ 2.6	2.6/ 12/ 2.5	.6/ 12/ .6
CO2 SAMPLE METER/RANGE/PCT	63.9/ 11/ .6284	49.2/ 11/ .4792	83.5/ 13/ .2085
CO2 BCKGRD METER/RANGE/PCT	5.3/ 11/ .0499	5.4/ 11/ .0509	19.8/ 13/ .0490
NOX SAMPLE METER/RANGE/PPM	1.0/ 1/ .3	.6/ 1/ .2	.6/ 1/ .2
NOX BCKGRD METER/RANGE/PPM	.5/ 1/ .1	.5/ 1/ .1	.6/ 1/ .2
DILUTION FACTOR	18.45	24.10	55.52
HC CONCENTRATION PPM	.72	.78	.47
CO CONCENTRATION PPM	8.52	23.88	3.42
CO2 CONCENTRATION PCT	.5812	.4304	.1604
NOX CONCENTRATION PPM	.14	.03	.00
HC MASS GRAMS	.033	.035	.021
CO MASS GRAMS	.731	2.052	.293
CO2 MASS GRAMS	783.9	581.1	216.3
NOX MASS GRAMS	.019	.004	.000
PART MASS GRAMS	.000	.000	.000
FUEL KG (LB)	.262 (.58)	.195 (.43)	.072 (.16)
KW HR (HP HR)	.68 (.92)	.25 (.33)	.00 (.00)
FILTER NUMBER			
WEIGHT GAIN (mg)	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000
BLOWER 1 SCF	2603.2	2606.2	2604.0
BLOWER 2 SCF	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: DFB-6
FUEL: LPG HD5
ENGINE: B

PROJECT: 08-8778-202
TEST DATE: 10/20/98

Mode	1	2	3	4	5	6	7	WEIGHTED TOTAL
Modal Weight Factor	0.06	0.02	0.05	0.32	0.30	0.10	0.15	
Total Flow, std. cu. ft.	2599	2638	2599	2601	2603	2606	2604	
Work, hp-hr	1	3.63	2.67	1.83	0.92	0.33	0	1.161
Dilution Factor	15.13	7.60	9.68	12.64	18.45	24.10	55.52	
HC Sample, ppm	4.7	26.1	10.5	5.5	4.6	4.8	4.5	
HC Background, ppm	4.7	4.6	4.2	4.1	4.1	4.2	4.1	
CH4 Sample, ppm	2.26	5.38	3.38	2.67	2.56	2.83	2.53	
CH4 Background, ppm	2.24	2.28	2.19	2.19	2.22	2.25	2.24	
NMHC Sample, ppm	2.0	19.7	6.5	2.3	1.6	1.4	1.5	
NMHC Background, ppm	2.0	1.9	1.6	1.5	1.5	1.5	1.4	
THC Sample, ppm	4.3	25.1	9.9	5.0	4.1	4.3	4.0	
THC Background, ppm	4.3	4.2	3.8	3.7	3.7	3.8	3.7	
HC Concentration, ppm	0.3	22.1	6.7	1.7	0.7	0.8	0.5	
CH4 Concentration, ppm	0.2	3.4	1.4	0.7	0.5	0.7	0.3	
HMHC Concentration, ppm	0.1	18.1	5.0	0.9	0.2	-0.0	0.1	
THC Mass, gram	0.01	1.01	0.30	0.08	0.03	0.03	0.02	0.08
CH4 Mass, gram	0.01	0.17	0.07	0.03	0.02	0.03	0.02	0.03
NMHC Mass, gram	0.00	0.82	0.23	0.04	0.01	-0.00	0.00	0.04
THC, g/hp-hr	0.01	0.28	0.11	0.04	0.04	0.11		0.07
CH4, g/hp-hr	0.01	0.05	0.03	0.02	0.02	0.10		0.03
NMHC, g/hp-hr	0.00	0.23	0.09	0.02	0.01	-0.00		0.04

ENGINE E 250-HOUR DURABILITY RESULTS

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

E

ENGINE NUMBER
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST 5-MODE-5 RUN
DATE 11/12/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 13 B BAG CART 2
Closed-Loop @ 250 hr

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50
Air Inj @ WOT

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	1800.	100.	83.	300.	1804.	83.	23.4	74.7	8.2	29.31	.925	1.034	.966	1.008
2	1800.	75.	62.	300.	1802.	63.	16.2	72.9	8.3	29.30	.927	1.033	.971	1.006
3	1800.	50.	41.	300.	1798.	42.	11.9	71.7	8.6	29.30	.934	1.029	.973	1.005
4	1800.	25.	21.	331.	1796.	21.	8.8	70.4	8.4	29.29	.930	1.031	.976	1.003
5	1800.	10.	8.	300.	1794.	9.	7.2	68.3	8.5	29.28	.931	1.031	.978	1.001

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	28.0	5.48	2904.0	3.1	.00	27900.
2	21.0	1.19	818.1	.1	.00	21191.
3	14.0	2.11	207.4	4.0	.00	16156.
4	7.0	2.17	248.8	1.3	.00	11851.
5	2.0	3.95	358.6	.2	.00	9429.

WEIGHTED RESULTS

MODE	WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.050	1.4	1.17	.27	145.20	.15	.00	1395.
2	.250	5.3	4.04	.30	204.52	.02	.00	5298.
3	.300	4.2	3.56	.63	62.23	1.21	.00	4847.
4	.300	2.1	2.64	.65	74.64	.38	.00	3555.
5	.100	.2	.72	.40	35.86	.02	.00	943.
TOTAL		13.2	12.1	2.3	522.4	1.8	.0	16038.

WEIGHTED MODAL CONTRIBUTION

MODE	G/HP-HR HC	G/HP-HR CO	G/HP-HR NOx	G/HP-HR PART	G/HP-HR CO2
1	.02	11.04	.01	.000	106.
2	.02	15.55	.00	.000	403.
3	.05	4.73	.09	.000	369.
4	.05	5.68	.03	.000	270.
5	.03	2.73	.00	.000	72.

COMPOSITE RESULTS

BSHC ------- =	.17	G/HP-HR	=	.23	G/KW-HR
BSCO ------- =	39.72	G/HP-HR	=	53.27	G/KW-HR
BSNOx ------ =	.14	G/HP-HR	=	.18	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	1219.	G/HP-HR	=	1635.	G/KW-HR
BSFC ------- =	.922	LB/HP-HR	=	.561	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

E

ENGINE NUMBER	TEST 5-MODE-5 RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 11/12/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2	ENGINE OIL 20W50
	Closed-Loop @ 250 hr	Air Inj @ WOT

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	99.2 (29.31)	99.2 (29.30)	99.2 (29.30)	99.2 (29.29)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	21.7 (71.0)/10.0	21.1 (70.0)/ 9.6	22.8 (73.0)/10.2	22.8 (73.0)/10.2
ENGINE AIR DEW PT., DEG. C (DEG. F)	10.8 (51.4)	10.9 (51.6)	11.3 (52.4)	11.1 (52.0)
ENGINE AIR TEMP, DEG. C (DEG. F)	23.7 (74.7)	22.7 (72.9)	22.1 (71.7)	21.3 (70.4)
ENGINE AIR: RH,% / AH,G/KG	44./ 8.2	47./ 8.3	51./ 8.6	52./ 8.4
NOx HUMIDITY C.F.	.925	.927	.934	.930
DRY-TO-WET C.F.	.966	.971	.973	.976
TIME SECONDS	300.0	300.0	300.0	331.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.65 (517.1)	13.68 (518.5)	13.67 (517.9)	13.64 (516.8)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.2 (2586.)	68.4 (2592.)	68.3 (2590.)	75.2 (2851.)
HC SAMPLE METER/RANGE/PPM	16.5/ 2/ 16.5	8.5/ 2/ 8.5	15.3/ 2/ 15.3	9.3/ 2/ 9.3
HC BCKGRD METER/RANGE/PPM	7.2/ 2/ 7.2	7.0/ 2/ 7.0	12.3/ 2/ 12.3	5.5/ 2/ 5.5
CO SAMPLE METER/RANGE/PPM	68.9/ 3/ 3004.9	45.2/ 2/ 836.6	87.7/ 13/ 211.2	56.1/ 14/ 252.0
CO BCKGRD METER/RANGE/PPM	.0/ 3/ .0	.0/ 2/ .0	.2/ 13/ .4	.0/ 14/ .0
CO2 SAMPLE METER/RANGE/PCT	29.2/ 2/ 1.7784	72.7/ 1/ 1.3538	55.8/ 1/ 1.0490	78.8/ 11/ .7819
CO2 BCKGRD METER/RANGE/PCT	.8/ 2/ .0509	2.3/ 1/ .0439	2.6/ 1/ .0496	5.0/ 11/ .0471
NOX SAMPLE METER/RANGE/PPM	10.0/ 1/ 2.6	2.0/ 1/ .5	12.0/ 1/ 3.1	4.4/ 1/ 1.1
NOX BCKGRD METER/RANGE/PPM	2.7/ 1/ .7	2.0/ 1/ .5	2.1/ 1/ .5	1.3/ 1/ .3
DILUTION FACTOR	6.34	9.12	12.21	16.20
HC CONCENTRATION PPM	10.45	2.27	4.01	4.15
CO CONCENTRATION PPM	2838.68	797.59	202.45	243.36
CO2 CONCENTRATION PCT	1.7355	1.3148	1.0034	.7377
NOX CONCENTRATION PPM	1.97	.06	2.56	.82
HC MASS GRAMS	.457	.099	.176	.200
CO MASS GRAMS	241.998	68.172	17.286	22.876
CO2 MASS GRAMS	2325.0	1765.9	1346.3	1089.7
NOX MASS GRAMS	.255	.007	.336	.117
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.883 (1.95)	.611 (1.35)	.448 (.99)	.367 (.81)
KW HR (HP HR)	1.74 (2.33)	1.30 (1.75)	.87 (1.17)	.48 (.64)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2585.7	2592.4	2589.7	2851.1
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

E

ENGINE NUMBER	TEST 5-MODE-5 RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 11/12/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2	ENGINE OIL 20W50
	Closed-Loop @ 250 hr	Air Inj @ WOT

MODE NUMBER	5
BAROMETER, kPa (IN HG)	99.1 (29.28)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.9 (75.0)/ 9.7
ENGINE AIR DEW PT., DEG. C (DEG. F)	11.2 (52.1)
ENGINE AIR TEMP, DEG. C (DEG. F)	20.2 (68.3)
ENGINE AIR: RH,% / AH,G/KG	56./ 8.5
NOx HUMIDITY C.F.	.931
DRY-TO-WET C.F.	.978
TIME SECONDS	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.71 (519.7)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.6 (2598.)
HC SAMPLE METER/RANGE/PPM	13.0/ 2/ 13.0
HC BCKGRD METER/RANGE/PPM	5.8/ 2/ 5.8
CO SAMPLE METER/RANGE/PPM	76.0/ 14/ 359.7
CO BCKGRD METER/RANGE/PPM	.1/ 14/ .4
CO2 SAMPLE METER/RANGE/PCT	63.9/ 11/ .6284
CO2 BCKGRD METER/RANGE/PCT	5.0/ 11/ .0471
NOX SAMPLE METER/RANGE/PPM	2.0/ 1/ .5
NOX BCKGRD METER/RANGE/PPM	1.5/ 1/ .4
DILUTION FACTOR	19.68
HC CONCENTRATION PPM	7.51
CO CONCENTRATION PPM	348.80
CO2 CONCENTRATION PCT	.5837
NOX CONCENTRATION PPM	.15
HC MASS GRAMS	.329
CO MASS GRAMS	29.880
CO2 MASS GRAMS	785.8
NOX MASS GRAMS	.019
PART MASS GRAMS	.000
FUEL KG (LB)	.272 (.60)
KW HR (HP HR)	.13 (.17)
FILTER NUMBER	
WEIGHT GAIN (mg)	.000
SAMPLE MULTIPLIER	.000
BLOWER 1 SCF	2598.3
BLOWER 2 SCF	.0
GAS METER 1 SCF	.000
GAS METER 2 SCF	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: 5-MODE-5 PROJECT: 08-8778-202
FUEL: CARB PHASE II TEST DATE: 11/12/98
ENGINE: E

Mode	1	2	3	4	5	WEIGHTED TOTAL
Modal Weight Factor	0.05	0.25	0.30	0.30	0.10	
Total Flow, std. cu. ft.	2586	2592	2590	2851	2598	
Work, hp-hr	2.33	1.75	1.17	0.64	0.17	1.081
Dilution Factor	6.34	9.12	12.21	16.2	19.68	
HC Sample, ppm	16.5	8.5	15.3	9.3	13	
HC Background, ppm	7.2	7	12.3	5.5	5.8	
CH4 Sample, ppm	8.99	3.57	5.01	4.75	5.77	
CH4 Background, ppm	2.12	2.13	2.13	2.09	2.11	
NMHC Sample, ppm	5.80	4.25	9.34	3.65	6.13	
NMHC Background, ppm	4.68	4.47	9.77	3.01	3.29	
THC Sample, ppm	14.79	7.82	14.35	8.40	11.90	
THC Background, ppm	6.80	6.60	11.90	5.10	5.40	
HC Concentration, ppm	10.44	2.27	4.01	4.14	7.49	
CH4 Concentration, ppm	7.20	1.67	3.05	2.79	3.77	
HMHC Concentration, ppm	1.86	0.28	0.37	0.82	3.01	
HC Mass, gram	0.456	0.099	0.175	0.199	0.329	0.188
CH4 Mass, gram	0.352	0.082	0.149	0.150	0.185	0.142
NMHC Mass, gram	0.081	0.012	0.016	0.040	0.132	0.037
HC, g/hp-hr	0.20	0.06	0.15	0.31	1.93	0.17
CH4, g/hp-hr	0.15	0.05	0.13	0.23	1.09	0.13
NMHC, g/hp-hr	0.03	0.01	0.01	0.06	0.78	0.03

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER E
ENGINE MODEL
ENGINE
ENGINE CYCLE OTTO

TEST 5-MODE-6 RUN
DATE 11/12/98 TIME
COMPUTER PROGRAM SSDIL 1.5 -R
CELL 13 B BAG CART 2
Closed-Loop

PHASE II EM-2491-F
HCR 2.03
C:.837 H:.142 O:.020 X:.000
ENGINE OIL 20W50
Air Inj @ WOT

MODE	TARGET SPEED RPM	TARGET LOAD PCT	TARGET TORQUE LB-FT	MEASURED TIME SEC	MEASURED SPEED RPM	MEASURED TORQUE LB-FT	C - B FUEL LB/HR	INTAKE AIR TEMP DEG F	INTAKE AIR HUMID G/KG	INTAKE AIR BARO IN-HG	FACTORS NOx HUM	FACTORS PART. HUM	FACTORS DRY WET	FACTORS F
1	1800.	100.	83.	300.	1798.	83.	23.3	72.3	9.0	29.20	.947	1.023	.965	1.010
2	1800.	75.	62.	300.	1802.	63.	16.0	72.3	9.0	29.20	.947	1.023	.970	1.010
3	1800.	50.	41.	300.	1798.	42.	11.8	71.1	9.0	29.19	.947	1.023	.973	1.009
4	1800.	25.	21.	300.	1796.	21.	8.8	68.9	9.2	29.20	.952	1.021	.975	1.006
5	1800.	10.	8.	300.	1802.	9.	7.4	68.2	9.2	29.20	.953	1.020	.977	1.005

MODE	BHP FROM WORK	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	28.0	6.08	2929.5	3.2	.00	27735.
2	21.0	1.27	845.2	.1	.00	20953.
3	14.0	2.08	298.6	2.1	.00	15971.
4	7.0	2.49	353.4	.7	.00	11735.
5	2.0	2.87	361.0	.2	.00	9675.

WEIGHTED RESULTS

MODE	MODE WF	POWER BHP	FUEL LB/HR	GRAMS/HOUR HC	GRAMS/HOUR CO	GRAMS/HOUR NOx	GRAMS/HOUR PART	GRAMS/HOUR CO2
1	.050	1.4	1.16	.30	146.47	.16	.00	1387.
2	.250	5.3	4.01	.32	211.30	.02	.00	5238.
3	.300	4.2	3.55	.62	89.58	.63	.00	4791.
4	.300	2.1	2.65	.75	106.03	.22	.00	3521.
5	.100	.2	.74	.29	36.10	.02	.00	967.
TOTAL		13.2	12.1	2.3	589.5	1.1	.0	15904.

WEIGHTED MODAL CONTRIBUTION

MODE	HC G/HP-HR	CO G/HP-HR	NOx G/HP-HR	PART G/HP-HR	CO2 G/HP-HR
1	.02	11.14	.01	.000	105.
2	.02	16.07	.00	.000	398.
3	.05	6.81	.05	.000	364.
4	.06	8.06	.02	.000	268.
5	.02	2.74	.00	.000	74.

COMPOSITE RESULTS

BSHC ------- =	.17	G/HP-HR	=	.23	G/KW-HR
BSCO ------- =	44.82	G/HP-HR	=	60.10	G/KW-HR
BSNOx ------ =	.08	G/HP-HR	=	.11	G/KW-HR
PARTICULATE =	.000	G/HP-HR	=	.000	G/KW-HR
BSCO2 ------ =	1209.	G/HP-HR	=	1622.	G/KW-HR
BSFC ------- =	.920	LB/HP-HR	=	.560	kG/KW-HR

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER	TEST 5-MODE-6 RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 11/12/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2	ENGINE OIL 20W50
	Closed-Loop	Air Inj @ WOT

MODE NUMBER	1	2	3	4
BAROMETER, kPa (IN HG)	98.9 (29.20)	98.9 (29.20)	98.8 (29.19)	98.9 (29.20)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/10.7	23.3 (74.0)/10.0	23.3 (74.0)/10.0	23.3 (74.0)/10.
ENGINE AIR DEW PT., DEG. C (DEG. F)	12.1 (53.7)	12.1 (53.7)	12.1 (53.7)	12.3 (54.2)
ENGINE AIR TEMP, DEG. C (DEG. F)	22.4 (72.3)	22.4 (72.3)	21.7 (71.1)	20.5 (68.9)
ENGINE AIR: RH,% / AH,G/KG	52./ 9.0	52./ 9.0	54./ 9.0	59./ 9.2
NOx HUMIDITY C.F.	.947	.947	.947	.952
DRY-TO-WET C.F.	.965	.970	.973	.975
TIME SECONDS	300.0	300.0	300.0	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.62 (516.0)	13.64 (516.8)	13.63 (516.6)	13.67 (518.2)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)	.0000 (.00)	.0000 (.00)	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.1 (2580.)	68.2 (2584.)	68.2 (2583.)	68.4 (2591.)
HC SAMPLE METER/RANGE/PPM	18.0/ 2/ 18.0	9.1/ 2/ 9.1	11.3/ 2/ 11.3	11.2/ 2/ 11.2
HC BCKGRD METER/RANGE/PPM	7.6/ 2/ 7.6	7.5/ 2/ 7.5	8.0/ 2/ 8.0	6.9/ 2/ 6.9
CO SAMPLE METER/RANGE/PPM	69.4/ 3/ 3051.2	46.5/ 2/ 869.3	68.7/ 14/ 318.8	76.4/ 14/ 362.0
CO BCKGRD METER/RANGE/PPM	.9/ 3/ 17.8	.3/ 2/ 4.1	4.0/ 14/ 15.9	1.3/ 14/ 5.1
CO2 SAMPLE METER/RANGE/PCT	95.4/ 1/ 1.7789	72.5/ 1/ 1.3502	55.6/ 1/ 1.0453	78.0/ 11/ .7736
CO2 BCKGRD METER/RANGE/PCT	3.1/ 1/ .0592	2.7/ 1/ .0515	2.9/ 1/ .0553	5.1/ 11/ .0481
NOX SAMPLE METER/RANGE/PPM	9.3/ 1/ 2.4	2.2/ 1/ .6	7.7/ 1/ 2.0	3.3/ 1/ .9
NOX BCKGRD METER/RANGE/PPM	1.7/ 1/ .4	2.2/ 1/ .6	2.8/ 1/ .7	1.6/ 1/ .4
DILUTION FACTOR	6.32	9.12	12.14	16.15
HC CONCENTRATION PPM	11.62	2.43	3.97	4.74
CO CONCENTRATION PPM	2869.88	826.78	292.20	344.81
CO2 CONCENTRATION PCT	1.7291	1.3043	.9946	.7285
NOX CONCENTRATION PPM	2.01	.06	1.31	.46
HC MASS GRAMS	.506	.106	.173	.207
CO MASS GRAMS	244.122	70.433	24.883	29.454
CO2 MASS GRAMS	2311.3	1746.1	1330.9	977.9
NOX MASS GRAMS	.266	.008	.174	.062
PART MASS GRAMS	.000	.000	.000	.000
FUEL KG (LB)	.879 (1.94)	.606 (1.34)	.447 (.99)	.334 (.74)
KW HR (HP HR)	1.74 (2.33)	1.30 (1.75)	.87 (1.17)	.43 (.58)
FILTER NUMBER				
WEIGHT GAIN (mg)	.000	.000	.000	.000
SAMPLE MULTIPLIER	.000	.000	.000	.000
BLOWER 1 SCF	2580.0	2583.8	2582.9	2590.9
BLOWER 2 SCF	.0	.0	.0	.0
GAS METER 1 SCF	.000	.000	.000	.000
GAS METER 2 SCF	.000	.000	.000	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
EPA ISO D2 ENGINE EMISSION RESULTS PROJECT NO. 08-8778-202

ENGINE NUMBER	TEST 5-MODE-6 RUN	PHASE II EM-2491-F
ENGINE MODEL	DATE 11/12/98 TIME	HCR 2.03
ENGINE	COMPUTER PROGRAM SSDIL 1.5 -R	C:.837 H:.142 O:.020 X:.000
ENGINE CYCLE OTTO	CELL 13 B BAG CART 2	ENGINE OIL 20W50
	Closed-Loop	Air Inj @ WOT

MODE NUMBER	5
BAROMETER, kPa (IN HG)	98.9 (29.20)
DIL. AIR: TEMP,DEG. C (DEG. F) / AH,G/KG	23.3 (74.0)/10.0
ENGINE AIR DEW PT., DEG. C (DEG. F)	12.4 (54.3)
ENGINE AIR TEMP, DEG. C (DEG. F)	20.1 (68.2)
ENGINE AIR: RH,% / AH,G/KG	61./ 9.2
NOx HUMIDITY C.F.	.953
DRY-TO-WET C.F.	.977
TIME SECONDS	300.0
TOT. BLOWER RATE, SCMM (SCFM)*	13.68 (518.3)
90MM SAMPLE RATE, SCMM (SCFM)*	.0000 (.00)
TOTAL FLOW STD. CU. METRES(SCF)*	68.4 (2592.)
HC SAMPLE METER/RANGE/PPM	11.8/ 2/ 11.8
HC BCKGRD METER/RANGE/PPM	6.7/ 2/ 6.7
CO SAMPLE METER/RANGE/PPM	79.8/ 14/ 381.6
CO BCKGRD METER/RANGE/PPM	4.8/ 14/ 19.1
CO2 SAMPLE METER/RANGE/PCT	66.4/ 11/ .6540
CO2 BCKGRD METER/RANGE/PCT	6.0/ 11/ .0566
NOX SAMPLE METER/RANGE/PPM	2.3/ 1/ .6
NOX BCKGRD METER/RANGE/PPM	1.8/ 1/ .5
DILUTION FACTOR	18.89
HC CONCENTRATION PPM	5.46
CO CONCENTRATION PPM	352.10
CO2 CONCENTRATION PCT	.6005
NOX CONCENTRATION PPM	.15
HC MASS GRAMS	.239
CO MASS GRAMS	30.085
CO2 MASS GRAMS	806.2
NOX MASS GRAMS	.021
PART MASS GRAMS	.000
FUEL KG (LB)	.279 (.61)
KW HR (HP HR)	.13 (.17)
FILTER NUMBER	
WEIGHT GAIN (mg)	.000
SAMPLE MULTIPLIER	.000
BLOWER 1 SCF	2591.5
BLOWER 2 SCF	.0
GAS METER 1 SCF	.000
GAS METER 2 SCF	.000

* SCF AT 68 DEG. F AND SCM AT 0 DEG C

NMHC EMISSIONS RESULTS

TEST NO: 5-MODE-6
FUEL: CARB PHASE II
ENGINE: E

PROJECT: 08-8778-202
TEST DATE: 11/12/98

Mode	1	2	3	4	5	WEIGHTED TOTAL
Modal Weight Factor	0.05	0.25	0.30	0.30	0.10	
Total Flow, std. cu. ft.	2580	2584	2583	2591	2592	
Work, hp-hr	2.33	1.75	1.17	0.58	0.17	1.096
Dilution Factor	6.32	9.12	12.14	16.15	18.89	
HC Sample, ppm	18	9.1	11.3	11.2	11.8	
HC Background, ppm	7.6	7.5	8	6.9	6.7	
CH4 Sample, ppm	9.69	3.42	5.12	5.32	5.67	
CH4 Background, ppm	2.2	2.16	2.18	2.17	2.18	
NMHC Sample, ppm	6.47	5.03	5.21	4.87	5.05	
NMHC Background, ppm	4.98	4.93	5.41	4.32	4.11	
THC Sample, ppm	16.16	8.45	10.33	10.19	10.72	
THC Background, ppm	7.18	7.09	7.59	6.49	6.29	
HC Concentration, ppm	11.60	2.42	3.96	4.73	5.45	
CH4 Concentration, ppm	7.84	1.50	3.12	3.28	3.61	
HMHC Concentration, ppm	2.28	0.64	0.25	0.82	1.16	
HC Mass, gram	0.506	0.106	0.173	0.207	0.239	0.189
CH4 Mass, gram	0.382	0.073	0.152	0.161	0.176	0.149
NMHC Mass, gram	0.099	0.028	0.011	0.036	0.051	0.031
HC, g/hp-hr	0.22	0.06	0.15	0.36	1.40	0.17
CH4, g/hp-hr	0.16	0.04	0.13	0.28	1.04	0.14
NMHC, g/hp-hr	0.04	0.02	0.01	0.06	0.30	0.03