Evaluation of the Impact on Emissions and Fuel Economy of Converting Two Vehicles to Compressed Natural Gas Fuel

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Background

The EPA was requested by the Department of Energy to perform testing on two late model vehicles which had been converted with on-the-market systems to run on compressed natural gas (CNG). The EPA was requested to measure vehicle emissions, fuel econony, and acceleration characteristics of the vehicles in stock configuration, modified running on gasoline, and modified-running on natural gas. The testing was run over a three week period with triplicate tests run in each condition. This report presents the results of the testing; but does not attempt to analyze the feasibility of CNG powered vehicles in the market place.

Test Procedure

Two vehicles were supplied by the Department of Energy. These vehicles (a 1980 Dodge Diplomat and a 1979 Chevrolet Impala) are more completely described in the attached Vehicle Description. The vehicles were checked against manufacturer's specifications upon arrival at the EPA Motor Vehicle Emission Laboratory (MVEL). Both vehicles met all specification tolerances. Prior to delivery, the vehicle exhaust systems were leak checked and new catalysts installed. All filters, spark plugs, PCV valves, and the normal tune-up items were replaced. The rear brakes were closely checked and worn components were replaced. Choke operation was specifically checked for correct operation prior to delivery.

The basic test procedures used were the Federal Test Procedure (FTP) and Highway Fuel Economy Test (HFET). The test plan called for three FTP/HFET sequences for each configuration. Methane, total hydrocarbons (HC), CO, CO2, and NOx emissions were measured. Fuel economy calculations based on the HC, CO, and CO2 emissions were calculated using the standard FTP procedure except for the actual CNG tests where carbon balance calculations based on the vehicle emissions and the chemical analysis of the CNG were used. There were several problems noted in the testing which required additional testing and are detailed below. Acceleration times from 5 to 60 mph at WOT and 30 to 60 mph at WOT were taken using a coupled roll Clayton dynamometer. No evaporative emissions were measured.

Test Results

The results of the testing are given in Tables I through VII. These results show several changes in emission levels for both the changes in fuel and the changes made in equipment.

First of all, these results show that the modifying of the engine to run on CNG has a detrimental effect on the gasoline-fueled emissions of the vehicle. For both vehicles, the modifications showed increases in HC, HC-NM, CO and NOx ranging from 12% to 40%. The HFET results showed both reductions and increases. The optimization of the added equipment showed varied results in HC, but significantly increased CO and NOx on the FTP. The HFET data again varied. The CNG test data showed reductions in HC-NM, NOx, and almost total elimination of CO emissions. However, methane emissions increased.

Acceleration test data is presented in Table VII.

Conclusions

The conclusions to be drawn from the testing performed are as follows:

- 1. The modifications required to convert the vehicles to dual-fuel capability have a detrimental effect on HC, CO, and NOx emissions during the FTP cycle.
- 2. The optimization of the conversion equipment did not return the test vehicle's emissions to baseline values. Both vehicles would run at higher emission levels on gasoline fuel when converted and optimized than they would run in stock configuration.
- 3. The emission data taken on compressed natural gas showed greatly reduced CO emissions and significant reductions in NOx and non-methane hydrocarbons.
- 4. The methane emissions of the vehicles running on compressed natural gas were significantly increased.
- 5. The acceleration data indicates a 50-60% decrease in acceleration performance. On vehicles with marginal performance, such a conversion might result in unsafe vehicle acceleration capabilities.
- 6. Both CNG systems appeared to be of good quality, were easy to use, and were designed to allow fuel switching with a minimum of problems.

Table I Chevrolet Impala - 1979 Federal Test Procedure Results in gms/mi

Test No.	Date	НС	Non-methane HC	co	Ga	MPG soline ilavent	Miles Per 100 SCF	Comments
80-8557 80-8559 80-8561	4/7/81 4/8/81 4/9/81	.3948 .3807 .3703	 .3207 .3133	9.347 10.007 9.605	1.0056 1.0164 1.0715	14.9584 14.5398 14.7984	N/A N/A N/A	Baseline Baseline Baseline
			was modifie cal gas equip					
80-8563	4/10/81	.4377		11.091	1.3173	15.5081	N/A	Modified
carbureto	c was cle	eaned. A	very poor. A missing fue k configurat	el filte	r spring v	vas added.		
80-8565 80-8567	4/14/81 4/15/81		.3438 .3427	9.065 9.408	1.8379 1.7412	14.7670 14.5369	N/A N/A	Baseline Baseline
			odified to i		the comp	essed nat	tural ga	s
80-8569 80-8571	4/16/81 4/17/81	.4597	.4032 .3692	10.991 10.889	2.1052 2.0473	14.6642 14.7190	N/A N/A	Modified Modified
			d by the CN fied-gasolin				o run o	n
80-8573	4/21/81	.5061	.4405	11.584	2.1141	14.5894	N/A	Modified
The vehic	le was th	nen switc	hed to run o	n natura	1 gas:			
80-8762 80-8764	4/22/81 4/23/81	.8020	.1487	.037	.9972 1.1439	14.3 14.5	10.0 11.2	CNG CNG

14.6

11.3

CNG

1.0764

.041

80-8166

4/24/81 .8124

.1514

Table II Chevrolet Impala - 1979 Highway Fuel Economy Tests

Test No.	Date	<u>HC</u>	Non-methane HC	<u>co</u>	Gas	PG oline lavent	Miles Per 100 SCF	Comments
80-8558 80-8560 80-8562	4/7/81 4/8/81 4/9/81	.0571 .0570 .0666	 .0374 .0448	1.774 1.694 2.464	1.0654 1.0791 1.0864	19.794 19.757 19.570	N/A N/A N/A	Baseline Baseline Baseline
			was modified al gas equipm					
80-8564	4/10/81	.0989		5.475	1.930	21.1166	N/A	Modified
carburetor	was cl	eaned. A	very poor. T missing fuel k configurati	lfilte	r spring w	as added.		
80-8566 80-8568	4/14/81 4/15/81		.0215 .0189	.8170 .6650		20.6051 21.0546	N/A N/A	Baseline Baseline
			odified to ing on gasoline		the compr	essed nat	cural ga	s
80-8570 80-8572		.0462	.0260 .0304	1.262 1.593	2.7075 2.6639	21.0543 20.981	N/A N/A	Modified Modified
The vehic			d by the CNG fied-gasoline				o run o	n
80-8574	4/21/81	.0370	.0200	.778	2.7374	20.995	n/ A	Modified
The vehic	le was ti	nen switc	hed to run on	natura	l gas:			
80-8763		.2876	.0459	0.0	1.3809	19.9	15.4	CNG
80-8765	4/23/83		.043	0.0	1.3313	19.4	14.8	CNG
80-8175 The vehic		L .2994 eturned t	.000	0.0	1.4703 on gasolin	20.0 e and a f	15.5 inal HFE	CNG T

.0470 .0271 1.532 2.7398 21.0886

N/A Modified

test was run.

80-8843

Table III

Dodge Diplomat - 1980
Federal Test Procedure in gms/mi

			. 1			MPG	Miles	
Test No.	Date	нс	Non-methane HC	СО	NOx	Gasoline Equilavent	Per 100 SCF	Comments
Test No.	Date					34-2-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3		
80-8538	4/7/81	.4023		7.3245			N/A	Baseline
80-8540	4/8/81	.3437		6.2005			N/A	Baseline
80-8542	4/9/81	.4856	.3793	8.0323			N/A	Baseline
80-8544	4/10/81	.36901		7.5846	1.12	28 16.6668	n/A	Baseline
						configuration ed but running		
80-8546	4/14/81	.47592	.3710	11.288	8 2.3	572 16.3241	N/A	Modified
The OSAC valve was			o have been	left of	f du	cing modificat	ion. Th	ae
80-8548	4/15/81	.52962	.4201	10.282	8 1.5	106 15.9259	N/A	Modified
80-8550	4/16/81	46293	.3748	8.237	2 1.7	140 16.2295	N/A	Modified
			ized by the	-	em r	epresentative	to run o	on
0-8552	4/17/81	.25672		8.904	5 1.6	195 16.6131	N/A	Modified
The vehic	le was th	nen switch	ed to compre	essed na	tural	gas.		
80-8554	4/21/81	1.10171		.005	3 1.2	225 16.7	12.8	CNG
80-8556		1.52284	.2513	(-).001			13.0	CNG
80-8768	4/23/81	1.31240	.2195	.003	9 1.2	264 17.2	13.3	CNG
A final mo	odified t	est runni	ng on gasoli	ine was	then	run.		
80-8841	4/24/81	.42039	.3277	10.260	5 1.4	196 15.6279	n/a	Modified

Table IV
Dodge Diplomat
Highway Fuel Economy Test in gms/mi

Test No.	Date	HC	on-methane HC	<u>co</u>	NOx 1	MPG Gasoline Equilavent	Miles Per 100 SCF	Comments
80-8539 80-8541 80-8543 80-8545	4/7/81 4/8/81 4/9/81 4/10/81	.2195 .02082 .02082 .0394	 .0117 	1.3066 1.2292 .9740 1.1867	.819	7 22.7972 6 22.3609	N/A N/A N/A N/A	Baseline Baseline Baseline Baseline
						configuration I but running		
80-8547	4/14/81	.02625	.0122	1.5439	•94	16 22.5938	N/A	Modified
The OSAC V			have been	left o	ff dur	ing the modi	fication	•
80-8549 80-8551	4/15/81 4/16/81		.0112	.8694 .7652	.93 .80		N/A N/A	Modified Modified
		•	ed by the (ted on gaso	-	em Rep	oresentative	to run o	n
80-8553	4/17/81	.01518	.0087	2.3559	• 54	48 21.7486	N/A	Modified
The vehicle	e was the	en switche	d to run on	compres	ssed n	atural gas.		
80-8555 80-8567 80-8769 A final mod	4/21/81 4/22/81 4/23/81 dified to	.29640 .51131	.000 .000 .0678 g on gasoli	0.0 0.0 0.0	1.28 .97 1.20	70 23.5 99 23.3	17.2 18.0 18.0	CNG CNG CNG
80-8769	4/24/81	.02813	.0195	1.64	.64	03 22.2445	N/A	Modified

 $\begin{array}{c} \textbf{Table V} \\ \textbf{Summary of HFET Results} \end{array}$

Α.	Dip	lomat				MPG	Miles	
# of Test		нс	HC-NM	<u>co</u>	NOx	Gasoline Equilavant	per 1000 SCF	Comments
4		.0258	.117*	1.1741	.8064	22.746	N/A	Baseline
2		.0215	.0115	.8173	.8716	22.707	N/A	Modified
2		.0217	.0141	1.998	.5926	21.997	N/A	Modified and Optimized
3		.4008	.0226	0.0	1.1568	23.1	17.73	CNG
		-16.7% -	90.17%* -	30.39%	+8.09%	17%		Modified compared to Baseline
		-15.9% -	87.95%* +	70.17%	-26.51%	-3.29%		Optimized compared to Baseline
		+1453.5%	-80.68%		+43.45%	+1.56%		CNG compared to Baseline
	o	+1747.0%	+60.28%		+95.21%	+5.01%		CNG compared to Optimized
В.	Imp	oala						
3		.0602	.0411	1.9773	1.0770	19.707	N/A	Baseline
2		.0357	.0202	.7410	1.7127	20.8299	N/A	2nd Baseline
2		.0486	.0282	1.4275	2.6857	21.010	N/A	Modified
2		.0420	.0236	1.1550	2.7386	21.0148	N/A	Modified and Optimized
3		.2855	.0296	0.0	1.3942	19.767	15.23	CNG
	+ 3	36.13%	+39.60%	+92.65%	+55.98%	+ .86%		Modified compared to Baseline
	+ :	17.65%	+16.83%	+55.87%	+87.48%	+1.02%		Optimized compared to Baseline
	+69	99.72%	+46.53%	00	-18.60%	+5.10%		CNG Compared to Baseline
	+57	79.76%	+25.42%	00	-49.09%	-6.06%		CNG Compared to Optimized

 $[\]star$ Only one Methane Result.

Table VI Summary of FTP Results

Α.	Diplomat						
# o		110 ID4	00	NO	MPG Gasoline	Miles per	Commants
Tes	ts HC	HC-HM	<u>co</u>	NOx	Equilavant	100 SCF	Comments
4	.4002	.3793*	7.2855	1.1633	15.5564	N/A	Baseline
2	.4963	.3975	9.2600	1.6123	16.0777	N/A	Modified
2	.3386	.3277	9.5825	1.5196	16.1205	N/A	Modified and Optimized
3	1.3123	.2354	.0027	1.1648	17.000	13.03	CNG
	+24.01%	+4.8%	+27.01%	+39.36%	-2.89%		Modified Compared Baseline
	- 15.4%	-13.6%*	+31.53%	+30.63%	-2.63%		Optimized Compared to Baseline
	+ 227.91%	-37.94%	-99.96%	+ .13%	+2.68%		CNG Compared to Baseline
	+ 287.57%	-28.17%	-99.97%	-30,46%	+5.46%		CNG Compared to Optimized
В.	Impala		•				
3	.3819	.3170	9.653	1.0312	14.7655	N/A	Baseline
2	.3961	.3433	9.2365	1.7412	11.652	N/A	Baseline
2	.4430	.3862	10.940	2.0763	14.6916	N/A	Modified
1	.5061	.4405	11.584	2.1141	14.5894	N/A	Modified and Optimized
1	.8152	1501	.0643	1.0725	14.4667	10.83	CNG
	+11.84%	+12.50%	+18.44%	+19.25%	+ .27%		Modified Compared to Baseline
	+27.77%	+28.31%	+25.42%	+21.42%	43%		Optimized Compared to Baseline
	+105.81% -	56.28%	-99.30%	-38.40%	-1.26%		CNG Compared to Baseline
	+ 61.07% -	65.93%	-99.44%	-49.27%	84%		CNG Compared to Optimized

^{*}Only one Methane Result

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Table VII
Acceleration Test Data

Run #	Vehicle	Time (sec 5 mph - 60	•	Time (second) $30 \text{ mph} - 60 \text{ mg}$	•
		Gasoline	CNG	Gasoline	CNG
1 2	Diplomat	20.0	30.4	16.0	25.2
	Diplomat	20.2	29.6	16.0	25.3
1	Impala	13.7	20.2	9.7	15.5
2	Impala	13.5	20.6	9.9	16.1

Method for Calculations of Fuel Economy of Compressed Natural Gas

- 1. An accurate CNG analysis based on a mole function basis is required. Attached are the two analysis of the CNG used during the test project.
- 2. Carbon weight fraction, carbon weight fraction not counting CO2, and hydrogen weight fraction of the CNG must then be calculated. An example is given below:

Component	Mole Fraction	Weight <u>Carbon</u>	Molecular Weight	Weight Hydrogen
N2	0.0450	0	1.26060	0
CO2	0.0043	0.05165	0.18924	0
Нc	0.0012	0	0.00480	0
CH4	0.9076	10.90132	14.56065	3.65933
С2Н6	0.0362	0.86961	1.08854	0.21893
С3Н8	0.0039	0.14053	0.17198	0.03145
i-C4H10	0.0005	0.02402	0.02906	0.00504
n-C4H10	0.0006	0.02883	0.03487	0.00605
i-C5H12	0.0002	0.01201	0.01443	0.00242
n-C5H12	0.0001	0.00601	0.00722	0.00121
C6H14	0.0002	0.01441	0.01724	0.00282
С7Н16	0.0001	0.00841	0.01002	0.00161
C8H18	0.0001	0.00961	0.01142	0.00181
Totals	1.000	$1\overline{2.06641}$	17.40007	3.93068

Carbon weight fraction = $\frac{\text{weight carbon}}{\text{molecular weight}} = 0.693 = X$

Carbon weight Fraction
for exhaust hydrocarbon = weight carbon not containing CO2 = 0.691 = Y
(not containing fuel CO2) molecular weight

Hydrogen weight Fraction = total weight of hydrogen = 0.226 = Z of Fuel molecular weight

3. Carbon Balance

grams of fuel
$$(X) = .429 \text{ CO} + .273 \text{ CO2} + [Y] \text{ (HC)}$$

HC, CO, CO2 are in grams/mile from FTP analysis.

4. Fuel Density
$$\frac{PM}{RT_{Air}} \text{ (S.G.)} = \frac{14.696 \text{ X } 144 \text{ X } 28.967 \text{ X } 453.592}{1545.33 \text{ X } 520} \text{ (S.G.) (100)}$$

= grams of fue1/100 SCF

5. Fuel Economy =
$$\frac{(gms/100 \text{ SCF})(X)}{.429 \text{ CO} + .273 \text{ CO2} + (Y) \text{ HC}}$$

6. Equivalent gasoline MPG Calculations. Using higher heating valve from CNG Analysis for 100 SCF.

Grams of fuel/100 SCF =
$$\left(\frac{PM}{RT}\right)$$
S.G.

Grams of Hydrogen = (grams of fuel/100 SCF)(Z) = A

$$H_{2}$$
0 produced per 100 SCF = A $((Z) 1.00797 + 15.9994)$ = E

$$\triangle$$
 Heating Value of H₂0 = (B) 453.592 1059.9 BTU/1b. = C

Lower Heating Value = Higher Heating Value - C in BTU/100 SCF = D.

Calculate equivalent volume on a BTU basis of 1 gallon of gasoline = BTU of one gallon of gasoline (100) =E

MPG gasoline equivalent =
$$\frac{\text{miles}}{100 \text{ SCF}}$$
 (E)

GAS ANALYSIS REPORT

4-16-81

DATE ANALYZED RUN NO. 81-477 YMAMMO CHIGAN CONSOLIDATED GAS COMPANY

GAS ANALYSIS MOLE % GROSS HEATING VALUE (BTU/SCF) LOCATION/14.734 SAT/14.65 DRY NSUFFICIENT SAMPLE NO 976 CALCULATED DETERMINED 4.24 TROGEN DETERMINED 1.23 RBON DIOXIDE 0.12 LIUM SPECIFIC GRAVITY 90.52 THANE 3.22 HANE LOCATION 0.45 OPANE .607 CALCULATED 0.06 BUTANE DETERMINED 0.07 BUTANE DETERMINED 0.02 PENTANE 0.02 'ENTANE 0.02 SULFUR (EXPRESSED AS H2S) GR/CCF ANES (C6) 0.01 (C7) PTANES HYDROGEN SULFIDE 0.01 TANES (C8) MERCAPTAN ANES 0.01 (C9) CANES SULFIDES (C10) RESIDUAL UECANES (C11) TOTAL SULFUR DECANES (C12)IDECANES (C13)OTHER RADECANES (C14)DROGEN HYDROCARBON LIQUID GAL/MCF 0.20 HYDROCARBON DEW POINT (F @ PSIG) 6 100.00 WATER DEW POINT (F @ PSIG) SAMPLE INFORMATION CYLINDER I.D. E.P.A. JECT CODE -ARTMENT TRANSPORTATION SAMPLE NO 1 ATION NOBLE GARAGE FOR E.P.A. SAMPLE POINT Auto Natural CITY DETROIT Gas Tank SAMPLING TIME .l_D SAMPLE RECEIVED 4-16-81 E MICHIGAN TALLATION NO. ATMOSPHERIC TEMP. F. GAS PRESSURE (PSIG) MIT NO. MATION GAS TEMP. F. WELL HEAD PRESS. (PSIG) TEM FLOW MMCF/DA ER SAMPLED BY D. EILERS CHASER SAMPLING PROCEDURE JECT GAS FUEL FOR GAS POWERED CAR % AIR % AIR NORMALIZED 0.00 ATED TESTS DISTRIBUTION DAVID EILERS & E. A. MORAN REMARKS N. R. MCEACHERN APPROVED BY Edward a Moran

MIS REPORT HAS BEEN PREPARED FOR THE PRIVATE AND EXCLUSIVE USE OF AMERICAN ATURAL RESOURCES SYSTEM COMPANIES AND ITS DELIVERY TO ANY OTHER PERSON IS ON THE EXPRESS UNDERSTANDING AND CONDITION THAT NO REPRESENTATIONS OR REPRESENTATIONS OF REALTH OF THE RESPECT TO THE CURACY OF ANY OF THE INFORMATION SET FORTH IN SUCH REPORT."

CNG SAMPLE #2 RECEIVED 24 APRIL 1981

GAS ANALYSIS REPORT DATE ANALYZED

RUN NO. 81-508

OMPANY
ICHIGAN CONSOLIDATED GAS COMPANY

4-23-81

GAS ANALYSIS	MOLE %		GROSS HEATING VALUE (BTU/SCF)	
SUFFICIENT SAM TROGEN RBON DIOXIDE	PLE	3.89 0.62	LOCATION/14.734 SA CALCULATED 987 DETERMINED DETERMINED	T/14.65 DRY 998	**************************************
LIUM		0.11	SPECIFIC GRAVIT		
THANE		91.41		1	
HANE		3.26	LOCATION		
OPANE		0.46	CALCULATED	.600	
BUTANE		0.07	DETERMINED		٠
BUTANE		0.08	DETERMINED		
PENTANE PENTANE		0.02			
CANES	(C6)	0.02			
PTANES	(C7)	0.02	SULFUR (EXPRESSED AS	HZ3) GK/CCF	
TANES	(C8)	0.01	HYDROGEN SULFIDE		
NANES	(C9)	0.01	MERCAPTAN		
CANES	(C10)	0.01	SULFIDES		
DECANES	(C11)		RESIDUAL		
DECANES	(C12)		TOTAL SULFUR		
IDECANES	(C13)				
TRADECANES	(C14)		OTHER		
DROGEN			HYDROCARBON LIQUID GAL/MCF		
TAL		100.00	HYDROCARBON DEW POINT (F @ WATER DEW POINT (F @ PSIG)	PSIG,	0.21 @ @
are given some stem dette stem stem stem stem stem stem stem		SAN	APLE INFORMATION		
DIECT CODE			CYLINDER I.D. E.P.A.		
FARTMENT NOE	LE TRANSPORT	ATION	SAMPLE NO 2		
TATION ANN AF		••	4	SAMPLE POINT	E.P.A. STA
ELD	CITY D	ETROIT	SAMPLING TIME 4-23-81		BOTTLE
TE MICHIGAN	•		SAMPLE RECEIVED		
STALLATION NO.			ATMOSPHERIC TEMP. F.		
WIT NO.			GAS PRESSURE (PSIG)		
.UMATION			GAS TEMP. F.		
STEM			WELL HEAD PRESS. (PSIG)		
TER			FLOW MMCF/DA		
.CHASER			SAMPLED BY E.P.A.		
RCE		•	SAMPLING PROCEDURE		
JECT GAS QUAI	LITY		% AIR		
ATED TESTS 1	E.P.A. TEST		% AIR NORMALIZED 0.00		
D	ISTRIBUTION		ANALYZED I	3Y	
E. 2	A. MORAN & DA	VE EILERS	N. R. MCEAC		
•	REMARKS		APPROVED I	BY	

THIS REPORT HAS BEEN PREPARED FOR THE PRIVATE AND EXCLUSIVE USE OF AMERICAN ATURAL RESOURCES SYSTEM COMPANIES AND ITS DELIVERY TO ANY OTHER PERSON IS SON THE EXPRESS UNDERSTANDING AND CONDITION THAT NO REPRESENTATIONS OR ARRANTIES, EXPRESS OR IMPLIED, ARE CONTAINED HEREIN WITH RESPECT TO THE COURACY OF ANY OF THE INFORMATION SET FORTH IN SUCH REPORT."

EXHAUST HECYCLE

VEHICLE SPECIFICATION REPORT - - DATE OF ENTRY: 4/ 6/61

VEHICLE SPECIFICATIONS

		UHEH				EPRESEN	TED CARL										
		5			1)				SEDAN	R	EAR URI	VE STR.	LEFT	ОТН	ER		
VEHICLE TYPE		UAL VEHICL			YEAR	E FULI	VE AXL W L EMP K TA	TY NK 1	WEIGHT	CLAS	IA T	IGHT (CODE	DYNO H		IMBER	
NUN-CER		VHOLET, IMP											1	•		LOAD	•
PRIMARY	DURAB.	ILITY VEHI	CLE ID OR										*IM	MFR	CONST	SWL E	M FT RH
												GR/8X156					42
							ENGINE	•									
ISPLACE	MENT	PORE	STHUNE	1ED	ENGINE TYPE	C	ANIDNÄ AHLDIANO	110%	NO. CYL.	NO. CARBS	TOTAL # BBLS	FUEL S	SYSTEM	FUEL	TURBO?	COMP. HATIO	COAST- DOWN TM
5	<u>.</u>	3./36							h		2				ИО		
IMINO 1	FIM	1110M 11M	· 44.4	KPM TUL.	Ut AK	LEFT	₩16H1 ₩ CO	COMB.	. TUL.	RPM	TOL.	GEAR	E.		AMILY		IE CODE
4 A			500	500	PARK							PARK		0024			
					DH I V	L THAIT	N AND CO										
XLF ATIU H	4/V 4/10	ODOMETER	A/C INSTALLE	e EX	HAUST TY	ret.							HAT IO	NI .	FUEL T		
•			YES						AUTU		AUTÓ	CANI	STER	IND	OLENE 30		
MATI APACITY	N-TANE V()LUME	AU. CAPACIT	xJANK y VO	I UME		SHI	F1 SPE	ED		EVA F	PORATIVE AMILY	EMIS	SION CUDE		SALES C	LASS
20.76																	
							CONTROL	SYSTE	M TYPE								

VEHICLE SPECIFICATION COMMENTS

UXIDATION CATALYST

DEPARTMENT ENERGY. DUEL FUEL CONVERSION VEHICLE

JIK PUMP

VEHICLE SPECIFICATION REPORT - - DATE OF ENTRY: 4/ 6/81

VEHICLE SPECIFICATIONS

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DEPARTMENT ENERGY. DUEL FUEL CONVERSION VEHICLE