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Emissions Characterization of Two Methanol Fueled Transit Buses

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Work Assignment 10

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Prepared for

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FOREWORD

The project on which this report is based was initiated by Work Assignment No. 10 of EPA Contract 68-03-3192, received by SwRI on April 8, 1985. The contract was for "Pollutant Assessment Support for the Emission Control Technology Division." Work Assignment No. 10 of that contract was specifically for "Testing of Two Methanol Transit Buses." The work was identified within SwRI as Project No. 03-7774-010.

The Project Officer and the Technical Project Monitor for EPA's Technology Assessment Branch during the Work Assignment were Mr. Craig A. Harvey and Mr. Thomas M. Baines, respectively. SwRI Project Director was Mr. Karl J. Springer, and SwRI Project Manager was Mr. Charles T. Hare. The SwRI Task Leader and principal investigator for the Work Assignment No. 10 effort was Mr. Terry L. Ullman. Lead technical person was Mr. Jim Chessher.

The cooperation of Acurex Corporation, Golden Gate Bridge Highway and Transportation District and the California Energy Commission in providing these methanol fueled buses for emissions testing on behalf of EPA is appreciated. We also would like to express our appreciation to VIA Metropolitan Transit of San Antonio for their assistance in loading and unloading the bus shipments.

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I. INTRODUCTION

Worldwide dependence on petroleum products and associated economic and environmental problems have focused attention on the use of alcohols as a substitute. Alcohols can be produced from both renewable and nonrenewable energy feedstocks, but have not been widely used to date as primary engine fuels for transportation uses because petroleum distillates were less expensive to produce and use. The diesel engine has been used with petroleum fuels for nearly a century. However, the use of petroleum-based fuels in diesel engine applications yields relatively high levels of several regulated pollutants, such as particulate matter and nitrogen oxides, as well as "nuisance" emissions such as smoke and odor. Diesel powered buses are one of the prime examples of a diesel engine application which has come under scrutiny due to concerns over emissions. Methanol fuel is considered to burn more cleanly than petroleum-based fuels, and it is easily produced from a variety of resources.

In the interest of reducing emissions and dependence on imported oil, the State Legislature of California directed the California Energy Commission (CEC) to undertake demonstrations of advanced fuel technologies - emphasizing methanol. One of these demonstrations consisted of two neat methanol powered transit buses,[1]* with one bus developed by Maschinenfabrik Augsburg-Nurnberg (M.A.N.) of Germany and the other by General Motors Corporation (GMC). Both methanol buses were placed in revenue transit service with the Golden Gate Bridge, Highway and Transportation District, to demonstrate the feasibility of operating methanol-fueled buses in such service. Smoke (visible particulate) emissions have been reported as low or non-existent on the two methanol buses, however, the effects of methanol fueling on other regulated and currently unregulated emissions are uncertain.

Methanol-fueled buses are being proposed, by EPA and others, as a potential solution to the current diesel bus particulate problem. However, there are no available data on emissions from methanol fueled buses operated on a chassis dynamometer, and only limited engine data are available. The objective of this work was to characterize the emissions behavior of the two methanol fueled buses[2] used in the California methanol demonstration on behalf of EPA.

The M.A.N. methanol bus tested in this program is one of many developed for evaluation throughout the world, and is one of the first to be evaluated in the United States. The GMC methanol bus represents the first methanol bus delivered by GMC and is actually a prototype. Both buses represent significant development efforts for both manufacturers. After about 2 years of operation for demonstration purposes, the M.A.N. accumulated 45,500 km (28,300 miles) and the GMC accumulated 30,500 km (18,900 miles).

*Numbers in parentheses designated references at the end of this report.

Exhaust emissions from both buses were characterized over chassis dynamometer operation at four steady-state conditions and on two transient test cycles. Emissions characterization included regulated emissions of HC, CO, NO_x, and particulate; along with unregulated emissions of unburned methanol, selected individual hydrocarbons, and aldehydes. The total particulate matter was characterized in terms of mass emissions, elemental content, and soluble organic fraction (SOF).

II. SUMMARY

Use of methanol fueled buses is being promoted as a step toward energy independence and improved air quality by displacing the use of petroleum based fuels. The California Energy Commission has sponsored the operation of two neat methanol fueled city transit buses to obtain in-service data. One of the methanol buses is a M.A.N. model SU 240 powered by a four-stroke M.A.N. D2566 FMUH methanol engine utilizing spark ignition. The other methanol bus is a GMC model RTS II 04, powered by a prototype two-stroke DDAD 6V-92TA methanol engine utilizing on-board computer control of methanol injection, scavenging air, and glow plugs to promote compression ignition of the methanol. The M.A.N. methanol bus uses an exhaust catalyst, the GMC methanol bus does not.

Exhaust emissions of both neat methanol fueled buses were determined over various types of chassis dynamometer cycles. Regulated and selected unregulated emissions were determined at steady-state conditions of cold idle in neutral, 20 kph cruise, 40 kph cruise, and hot idle in drive, and over the transient conditions of the central business district (CBD) and the EPA bus cycles. With the exception of cold idle operation, all test work was conducted with a warm engine (and warm catalyst on the M.A.N. bus). Emission results from the M.A.N. and the GMC methanol buses are summarized in Tables 1 and 2, respectively. Methanol fuel economy is given for comparison purposes, but also to facilitate conversion of the emissions results to a methanol fuel specific basis. Diesel equivalent fuel economy is given for reference purposes. It should be noted that although simulated passenger loads (25 passengers with a driver) were the same for both buses, the GMC chassis was substantially heavier (1900 kg) than the M.A.N. chassis and was equipped with a wheel chair lift.

Warm engine/catalyst emissions of HC and CO from the M.A.N. bus were very low, indicating that the oxidation catalyst was very effective. Only low levels of methane (representing most of the total IHC) and formaldehyde (representing most of the total aldehydes) were noted for warm engine/catalyst operation over the various test conditions. Emissions of NO_x were lower than typical diesel levels. Total particulate emissions from cold and warm engine operation were very low (no visible staining on the collection filter). In the case of cold idle (with little or no catalyst activity), the soluble organic fraction (SOF) accounted for essentially all the total particulate emission. For warm engine/catalyst operation, however, the SOF accounted for 10 to 50 percent of the total particulate. Analyses of the SOF and lubricating oil indicated that the SOF of the total particulate originated as engine lubricating oil.

Emission levels of total HC (mostly unburned methanol) over both cold and warm engine operation of the GMC were very high. Unburned methanol emissions represented 8 to 20 percent of the fuel supplied over some test conditions. Methane, ethylene, and lesser amounts of other individual hydrocarbon emissions were noted for the GMC methanol bus. Total aldehyde emissions were primarily made up of formaldehyde with some acetaldehyde and lesser amounts of other aldehyde species. The GMC's very high HC (unburned methanol) and CO emissions, along with very low NO_x emissions, are likely due in part to poor combustion quality. Total particulate emissions for the GMC methanol bus were lower than for a diesel bus, but greater than expected for an

TABLE 1. SUMMARY OF EMISSIONS FROM THE M.A.N. SU 240 METHANOL BUS

Chassis Test Procedure	Steady-State Operation				Transient Cycles	
	Cold Idle[d]	Hot Idle[d]	20 kph[d]	40 kph[d]	CBD	Bus
Hydrocarbons,[a] HC[e] g/km, (g/hr)	(225)	(4.6)	0.63	0.45	0.53	0.85
Carbon Monoxide, CO g/km, (g/hr)	(56)	(2.3)	0.31	0.21	0.48	0.33
Oxides of Nitrogen, NO_x[e] g/km, (g/hr)	(47)	(67)	3.3	2.4	8.8	8.1
Fuel Economy[b] km/kg, (kg/hr)	(7.0)	(7.2)	1.5	2.3	1.0	1.2
Diesel Fuel Equivalent[c] km/kg, (kg/hr)	(3.2)	(3.3)	3.2	5.1	2.2	2.6
Total Individual HC mg/km, (mg/hr)	(840)	(41)	43	4.0	79	28
Total Aldehydes mg/km, (mg/hr)	(14,000)	(2,100)	180	39	100	84
Unburned Methanol mg/km, (mg/hr)	(230,000)	(8,500)	1,600	490	350	1,100
Total Particulate g/km, (g/hr)	(0.58)	(0.81)	0.035	0.025	0.063	0.043
Soluble Organic Fraction g/km, (g/hr)	(0.58)	(0.086)	0.0067	0.0083	0.022	0.021

[a]HC emissions have been increased to account for the 0.8 response factor of the FID to methanol, and are based on a molecular weight of 32
[b]Fuel consumption figures were computed by carbon balance
[c]Diesel fuel equivalent was computed using a factor of 2.17
[d]15 minutes test duration
[e]Based on continuous measurement

NOTES:

1. Emissions in units of gram per kilometer (or milligram per kilometer) can be easily converted to units of gram per mile (or milligram per mile) by multiplying the former values by 1.61.
2. Fuel economy in units of kilometer per kilogram can be converted to miles per gallon of methanol by multiplying by a factor of 1.86.

TABLE 2. SUMMARY OF EMISSIONS FROM THE GMC RTS II 04 METHANOL BUS

Chassis Test Procedure	Steady-State Operation				Transient Cycles	
	Cold-Idle[d]	Hot-Idle[d]	20 kph[d]	40 kph[d]	CBD	Bus
Hydrocarbons,[a] HC[e] g/km, (g/hr)	(2,300)	(530)	120	110	g/mile 60/97	74
Carbon Monoxide, CO g/km, (g/hr)	(440)	(290)	32	27	55/89	78
Oxides of Nitrogen, NO_x[e] g/km, (g/hr)	(19)	(3.6)	1.3	1.6	4.9/7.9	4.9
Fuel Economy[b] km/kg, (kg/hr)	(13)	(6.5)	1.2	1.4	0.71	0.65
Diesel Fuel Equivalent[c] km/kg, (kg/hr)	(6.0)	(3.0)	2.6	3.1	1.5	1.4
Total Individual HC mg/km, (mg/hr)	(3,000)	(1,600)	170	110	600	820
Total Aldehydes mg/km, (mg/hr)	(35,000)	(23,000)	2,400	1,200	1.9 g/mile 1,200	1,700
Unburned Methanol mg/km, (mg/hr)	(2.7×10^6)	(380,000)	110,000	120,000	100 g/mile 62,000	82,000
Total Particulate g/km, (g/hr)	(6.8)	(3.8)	0.33	0.19	1.54 g/mile 0.96	0.39
Soluble Organic Fraction g/km, (g/hr)	(5.7)	(3.0)	0.28	0.16	0.84	0.33

[a]HC emissions have been increased to account for the 0.8 response factor of the FID to methanol, and are based on a molecular weight of 32
[b]Fuel consumption figures were computed by carbon balance
[c]Diesel fuel equivalent was computed using a factor of 2.17
[d]15 minutes test duration
[e]Based on continuous measurement

NOTES:

1. Emissions in units of gram per kilometer (or milligram per kilometer) can be easily converted to units of gram per mile (or milligram per mile) by multiplying the former values by 1.61.
2. Fuel economy in units of kilometer per kilogram can be converted to miles per gallon of methanol by multiplying by a factor of 1.86.

engine using neat methanol (including light gray staining on collection filters). Results from analysis of the SOF, which constituted about 85 percent of the total particulate, were compared to results from a similar analysis of lubricating oil, indicating that the SOF (hence, most of the total particulate) originated from the lubricating oil.

III. TEST PLAN AND DESCRIPTION OF METHANOL BUSES AND PROCEDURES

The intent of this program was to characterize regulated and unregulated emissions from the M.A.N. and the GMC methanol buses. This section describes the test plan used in the program. Some of the pertinent specifications of the buses and their respective engines are given along with some of the properties of the neat methanol fuel used during this test work. Procedures are described, including both the test procedures used to generate and acquire emissions samples and the analytical procedures used to characterize the emission samples. For the purposes of quality assurance, an assessment of the data accuracy, precision and completeness is given in this section of the report.

A. Test Plan

The planned program included measurement of both regulated and unregulated emissions from both methanol fueled buses over six chassis test cycles as indicated in Table 3.[2] Some analysis of crankcase oil was planned in connection with analysis of the soluble organic fraction (SOF) of the total particulate. Since particulate levels were anticipated to be very low, plans to clean the dilution tunnel were made. Provisions to extract blank filters were made in order to determine the "background" contribution to the extractable portion (SOF) of the total particulate. In addition, modifications to the computer program were planned to process emissions data accumulated on methanol fuel. Emission samples outlined in Table 3 were to be obtained in triplicate for each bus and processed individually whenever possible. Therefore, most of the emissions data to be presented in summary form would be the results of three determinations.

B. Description of Test Vehicles

Both methanol powered buses were obtained from the California Energy Commission's "Methanol Bus Demonstration Project" being conducted in California.[2,3] The buses were delivered to SwRI on behalf of EPA for emission testing after approximately two years of revenue service in the San Francisco area. Some of the pertinent descriptive information on both buses is given in Table 4.

The M.A.N. methanol bus is a model SU 240, and is a standard European intercity coach as shown in Figure 1. This bus is powered by a M.A.N. D2566 FMUH engine, developed for consuming a variety of low-cetane fuels. This engine is based on a M.A.N. diesel engine design and has an 18:1 compression ratio. Ignition of the methanol is accomplished by a timed spark ignition system.[4] This naturally aspirated, four-stroke, in-line 6-cylinder engine is essentially the same as tested on an engine dynamometer in an earlier EPA program.[5] Figure 2 shows the engine compartment of the M.A.N. SU 240 methanol bus with the horizontal configuration of the engine. Figure 3 shows the spark plug wires. The ignition system and spark plugs are still under development to extend their service. Power for air conditioning on the bus is supplied by a small auxiliary diesel engine.

TABLE 3. TABLE OF EMISSIONS AND CYCLES FOR METHANOL-FUELED BUS TESTING

Emissions	Test Cycle: Central Business District	Unfiltered Bus Cycle	Steady State: Cold Idle	Hot Idle	12.5 MPH	25 MPH
HC						
Indiv.	X	X	X	X	X	X
Total	X	X	X	X	X	X
CO						
CO_2 (for fuel economy	X	X	X	X	X	X
NO_x (bag and continuous)	X	X	X	X	X	X
Aldehydes						
Individual	X	X	X	X	X	X
Total	X	X	X	X	X	X
Methanol	X	X	X	X	X	X
Particulate						
Mass	X	X	X	X	X	X
SOF	X	X	X	X	X	X
Metals	X	X		X		X
Boiling Range of SOF	X	X				

Analysis of a lubricating oil sample from each engine will be made for metals and soluble organic fraction boiling range.

Metals analysis will be performed by EPA/RTP.

TABLE 4. METHANOL BUS SPECIFICATIONS AND TEST WEIGHTS

Manufacturer	M.A.N.	GMC
Model	SU 240	RTS II 04
Length, m (ft.)	11.6(38)	12.2 (40)
Passenger Cap. (seated)	49	43
Transmission Model	Voith D 854	Allison V730D
Axle Ratio	5.936	4.556
Tire Size	11R 22.4 x 2A	12.5 x 22.5
Engine Model	M.A.N. D2566 FMUH	DDAD 6V-92 TA Methanol
Displacement, liter	11.4	9.05
Rated Power, kW @ rpm	147 @ 2200	207 @ 2100
Engine Cycle	4-Stroke	2-Stroke
Compression Ratio	18:1	19:1
Ignition System	Spark	Compression[b]
Intake Air	Naturally Aspirated	Turbo & Blower
Service Accumulation, km (miles)	45,500 (28,300)	30,500 (18,900)
Curb Weight[a], kg (lb)	11,100 (24,500)	13,000 (28,700)
Test Inertia Weight, kg (lb)	12,800 (28,300)	14,800 (32,600)

[a]Weight as received with fuel tanks filled, bus empty
[b]With glow plug assist at light loads plus scavenging air management

Figure 1. M.A.N. SU 240 methanol bus positioned for emissions testing

Figure 2. Engine compartment of the M.A.N. SU 240 methanol bus with exhaust routed to CVS

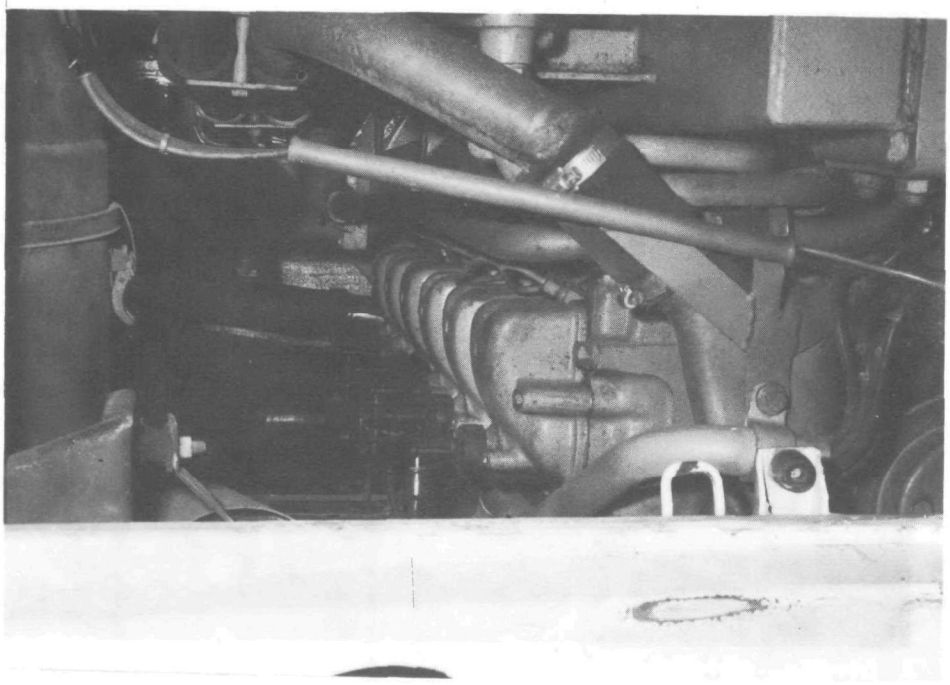

Figure 3. Close-up of M.A.N. SU 240 methanol bus engine head with spark ignition

Figure 4. GMC RTS II 04 methanol bus positioned for emissions testing

The M.A.N. bus uses a catalyst for exhaust aftertreatment to reduce emissions of unburned methanol and aldehydes. The exhaust catalyst consists of two units operated in parallel. Each unit contains about 2.9 liters of Corning ceramic monolith substrate M 20/400 (20 mil wall and 400 cells/in.^{2}) in an oval shape (3.2 x 6.7 inch) and handles the flow from 3 of the 6 cylinders. The catalyst coating was supplied by Engelhard Kali-Chemie GmbH and is described as a "diesel oxidation catalyst with 1766 g/m^3 (50 g/ft^3) of platinum." Final assembly of the units was performed by Zeuna-Staerker AG.

Prior to transport, routine maintenance had been completed and a new catalyst fitted to replace one which had failed due to loss of spark ignition. Operation and driveability of the bus were deemed typical and acceptable before shipment to SwRI. The M.A.N. was received with approximately 45,500 km (28,300 miles).

The GMC methanol bus, shown in Figure 4, is a model RTS II 04, which is typical of the majority of city transit buses used in the United States. The methanol engine was developed from the GMC Detroit Diesel Allison Division (DDAD) 6V-92TA diesel engine. The DDAD 6V-92TA methanol engine shown in Figure 5 is of two-stroke design and relies on compression ignition of methanol. Compression ignition of methanol occurs unassisted during high load conditions. The design relies on control of scavenging air to maintain ignition during moderate loads. In addition, glow plugs are used to assist light load, idle and start-up operation of the GMC methanol engine. The methanol engine utilizes electronically controlled injectors. The GMC methanol bus uses an on-board computer to vary scavenging air, glow plug operation, fuel delivery, and injection timing relative to throttle demand and engine parameters. Some of the control actuators associated with the throttle and the scavenging air control are shown in Figure 6.[3,6]

Prior to shipment, preventive maintenance was conducted on the GMC methanol bus, including checks of the glow plug voltages and the parameters monitored and used by the on-board computer. Operation and driveability were deemed typical and acceptable before shipment to SwRI. The GMC bus was received with approximately 30,400 km (18,900 miles) accumulated.

C. Description of Test Fuel

Both buses were received with on-board tanks full of neat methanol provided from the bulk supply fuel point at the Golden Gate Transit garage. Grab samples from both buses were analyzed for methanol, other alcohols, and water content. Analyses of these two samples are given in Table 5, confirming that the fuel used was at least a "fuel quality" methanol, and that the higher alcohols were essentially negligible. The heating value of the fuel methanol was not determined in this program. For the sake of computing diesel fuel equivalents, heating values of 19.7 and 42.8 MJ/kg were taken for methanol and diesel fuel, respectively, yielding a ratio of 2.17 mass units of methanol/mass unit of diesel fuel for equivalent heat energy. Since both buses were serviced prior to shipment, no fuels or lubricants were added by SwRI.

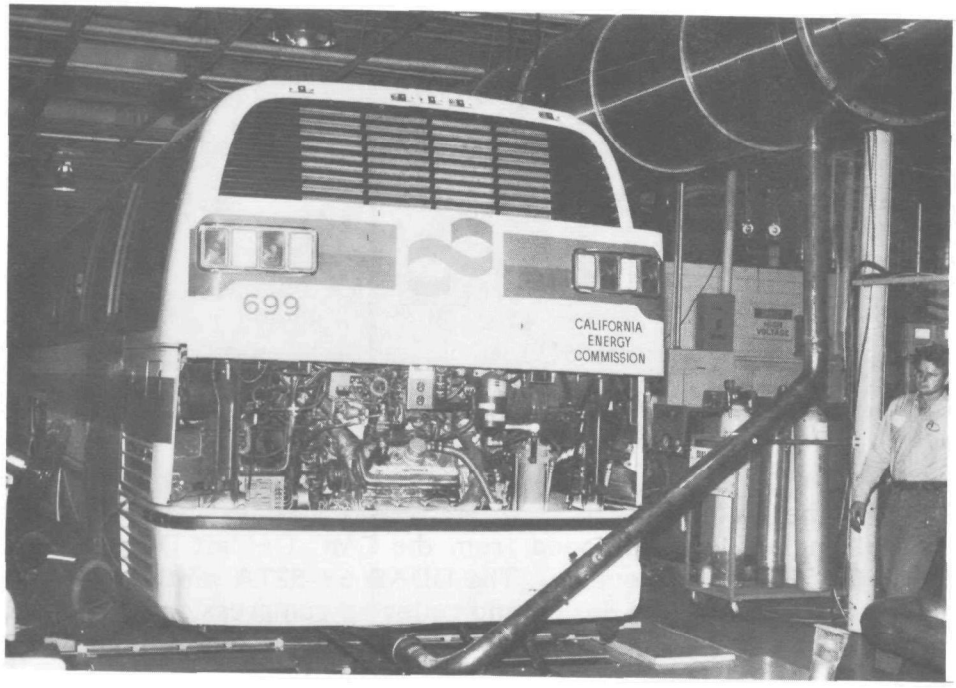

Figure 5. Engine compartment of the GMC RTS II 04 methanol bus with exhaust routed to CVS

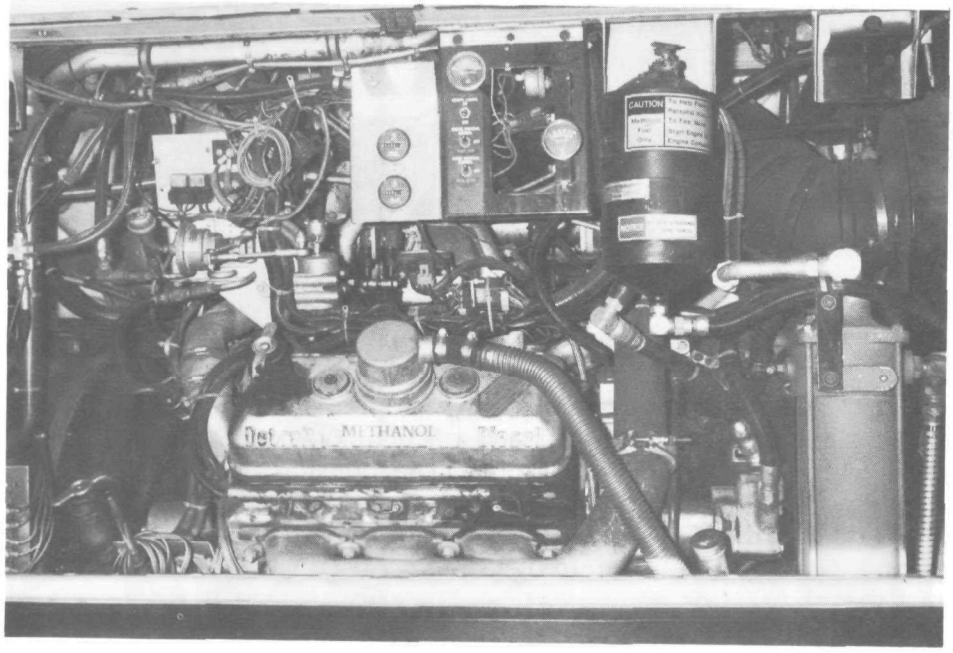

Figure 6. Close-up of methanol engine installation on GMC RTS II 04 bus

TABLE 5. SELECTED PROPERTIES OF TEST FUEL

Bus	M.A.N.	GMC
Sample No.	698	699
Gravity, API°	46.0	45.7
Specific Gravity	0.797	0.798
Methanol, %	99	99
Ethanol, %	0.1	0.1
TBA, %	0.1	0.1
Water, ppm	590	540

D. Test Procedures

Each of the methanol buses was transported to and from California by way of truck-trailer due to the lack of maintenance support and fuel supply enroute. Upon arrival, the bus was off-loaded, and a basic operational check was performed, allowing the driver to become familiar with the controls. The bus was driven to a public scale for weight determination and returned to the laboratory for dynamometer set-up.

The chassis testing in this program was based on the test procedure outlined in EPA's "Recommended Practice for Determining Exhaust Emissions From Heavy-Duty Vehicles Under Transient Conditions."[7] The chassis dynamometer used in this program was a tandem-axle Clayton heavy-duty chassis dynamometer modified by the addition of eddy current power absorbers. Electronic programming of the system enables the use of almost any required speed-power curve. By utilizing an electrical signal from the vehicle braking system, electrical braking of the dynamometer rolls is also provided. Each of the absorption units in tandem has dual rolls that are 8.625 inches in diameter. Inertia simulation is provided by an appropriate combination of directly-connected inertia wheels. Maximum inertia simulations readily attainable are 49,000 pounds for single-drive-axle vehicles and 76,000 pounds for tandem-drive-axle vehicles. Using the programmable dynamometer, the procedure developed for road load simulation of a vehicle involves establishing the speed-power curve, determining inertia simulation, and determining system friction.

The equation selected for calculation of the speed-power curve used for evaluations on the chassis dynamometer is as follows:

$$RLP = F \times 0.67(H - 0.75)\, W \times (V/50)^3 + 0.00125 \times LVW \times V/50$$

Where:

- RLP = Road Load Power, horsepower
- F = 1.00 for tractor-trailer and 0.85 for city bus
- H = Average maximum height, feet
- W = Average maximum width, feet
- LVW = Loaded vehicle weight, pounds
- V = Velocity, mph

The equations used for determination of dynamometer torque and load are as follows:

Dynamometer torque, foot-pounds = Power, hp x 134.8/Velocity, mph
Dynamometer Load, pounds = Torque x 12/Load Arm, inches

These equations were developed in conjunction with experimental data obtained with trucks and buses and reported in reference 8.

Once the appropriate inertia wheels were fitted to the dynamometer, the bus was positioned on the rolls. The rear axle vertical loading was reduced by blocking up the frame of the bus, and cooling fans were positioned to reduce the risk of tire damage. With the bus in position, bus exhaust-to-CVS piping was installed.

With vehicle installation complete the total system absorbed horsepower was determined using coastdowns. This was accomplished by obtaining repeatable 88 to 8 kph coastdown speed versus time data and then solving for the instantaneous decelerations. From the instantaneous decelerations, the power absorption of the vehicle-dynamometer system was determined as a function of vehicle speed. The speed-power curve for programming into the dynamometer controller was then determined by difference between the total power required on the road (based on previous documentation[8]) and the power absorbed by the vehicle-dynamometer system.

Both methanol buses were tested over six chassis cycles or operating conditions which included steady-state operation at cold idle, 20 kph, 40 kph, and hot idle; and transient operation over the central business district (CBD) and bus cycles. All test work was conducted with the air conditioning and all other accessories turned off.

The cold idle steady-state was conducted with the transmission in neutral position. Emissions sampling commenced with engine cranking and start of the engine. The engine was allowed to idle in neutral and emission samples were taken for 15 minutes. Although it is unlikely that a 15-minute idle in neutral would occur in field operation, the prolonged idle was used to accumulate adequate samples for analysis. The term "cold", as it is used in this report, refers to the engine being allowed to stand overnight in an ambient temperature between 20 to 30°C (68 to 86°F) prior to and during engine start-up.

After completing cold-idle emissions sampling the bus was operated in a warm-up mode, then held at 80 kph to check the dynamometer load setting. Once the load was confirmed, emissions testing proceeded with the 20 kph steady-state, then the 40 kph steady-state and finally the hot-idle steady-state. The hot-idle steady-state was conducted with the transmission in drive and the brakes set. Emission samples were collected over a 15-minute period at each condition to allow adequate time for sample accumulation.

Emission samples were also taken over the CBD and the bus cycles. The CBD cycle is one of four transit coach operating profile duty cycles proposed and used for evaluation of bus fuel economy.[9] For this work, the CBD cycle was composed of 14 repetitions of the basic cycle, which included idle,

acceleration, cruise, and deceleration modes. An example of this basic cycle is given in Figure 7, and it was repeated 14 times for a chassis driving cycle time of 580 seconds and a distance of 2.0 miles (3.2 km).

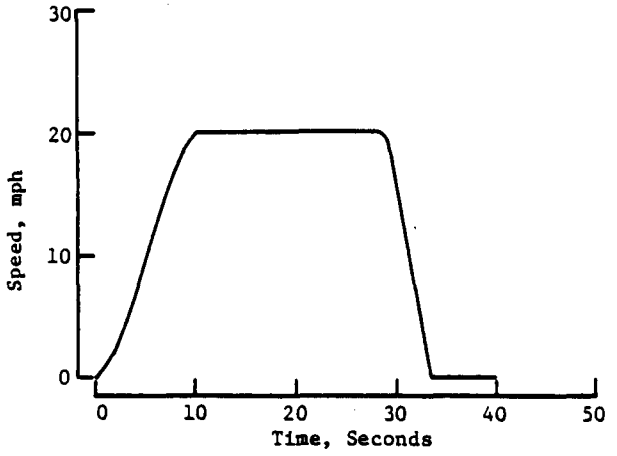

Figure 7. One segment of the CBD test cycle

Data accumulated from bus operation (CAPE-21)[10] were used to develop a "heavy-duty chassis bus driving cycle."[11] The driving schedule shown in Figure 8 was used in this program as the "Bus Cycle." Of the 1191 second duration of the cycle, 394 seconds are idle, all of which is with the transmission in "drive." The distance of the bus cycle is 2.90 miles. The maximum speed called for by the cycle is 36 mph. The bus cycle contains many sharp accelerations and decelerations requiring full pedal deflection one moment and braking the next.

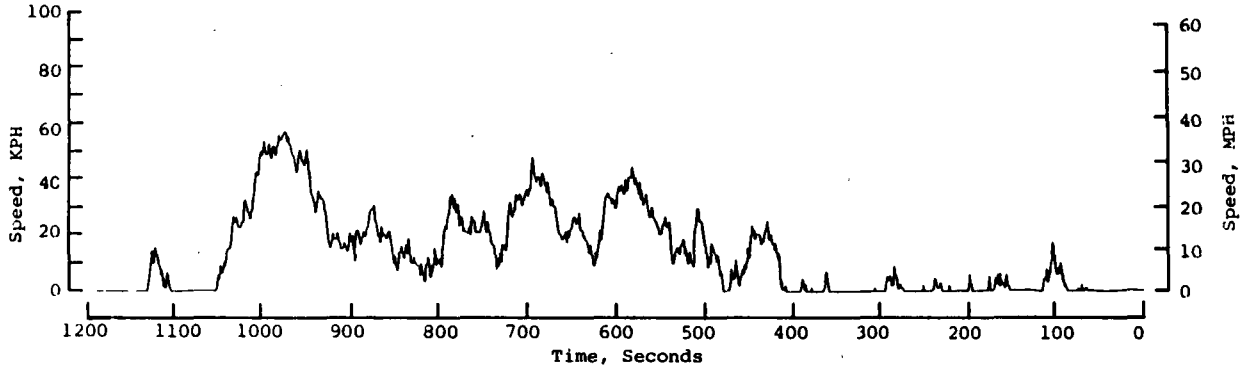

Figure 8. Heavy-duty chassis bus driving cycle

E. Analytical Procedures

Emission measurements were based on procedures established for the 1984 transient testing of heavy-duty diesel engines[12] and on procedures outlined in EPA's "Recommended Practice for Determining Exhaust Emissions From Heavy-Duty Vehicles Under Transient Conditions."[7] Figures 1 and 4 show the methanol buses next to the single-dilution CVS used in conjunction with heavy-duty chassis test work. All the engine exhaust gases generated were transferred to the CVS by a 4-inch diameter exhaust tube as shown in Figures 2 and 5. The single-dilution CVS has a capacity from 1000 to 12000 SCFM .

The CVS dilution tunnel is 46 inches in diameter and 57 feet long. This system has the capacity to obtain three 20 x 20 inch filter samples of particulate matter along with additional samples needed for analysis of the total particulate. All testing was conducted with the CVS since particulate emissions were to be measured over all test conditions.

Extremely low particulate rates were expected, so the CVS dilution tunnel and the associated sampling systems were cleaned to reduce the potential for particulate sample interference due to tunnel background particulate. After cleaning, the CVS and its associated sample systems were operated to verify low background levels. Propane checks were used to assure that CVS volume curves were adequate to provide propane recovery within two percent prior to emissions testing.

Total hydrocarbons were measured over each test cycle by integration of continuous hydrocarbon monitoring of the CVS-diluted exhaust, and by analysis of a proportional sample of the CVS-diluted exhaust collected in a bag. For continuous analysis of total hydrocarbons, the sample was transferred from the CVS to the Beckman 402 heated flame ionization detector (HFID) by a heated diesel sample train. Normally, the heated sample train is maintained near 375°F. However, methanol undergoes increased dissociation into H_2 and CO at temperatures above 250°F.[13] To reduce the potential problem with methanol dissociation, the continuous HC sample train was maintained near 175°F. For bag determinations, a proportional sample was transferred from the CVS to the bag by an unheated sample train; then shortly after sampling was completed, the HC concentration in the bag was determined using a HFID.

Total HC emissions are based on indications from the HFID, which has been calibrated on propane. However, the HFID response to various species of alcohols, some individual hydrocarbons, aldehydes, and phenols often differs from the response to propane. The methanol response of both HFID instruments used in this program was determined to be 0.80, based on a 90 ppm methanol-in-air gas standard. The concentrations determined by both HFID instruments during testing were used in processing the test data on the basis of bag measurement or continuous measurement. Resultant HC emission levels were divided by 0.80 to account for the 0.80 response factor of the HFID to methanol.

Total hydrocarbons are generally assumed to be of the same general composition as the fuel. In the case of these methanol fueled buses, the total hydrocarbons are reported on the basis that the "HC" represents methanol. Therefore, the weight of oxygen is included in the "HC" emissions unless stated otherwise. Specifically, a HC density of 37.69 g/ft^3 was used in the computation (16.33 g/ft^3 is specified in the Federal Register for use of fuels with a H/C ratio of 1.85) of HC mass from concentration ppmC levels obtained from analysis by HFID.

Unburned methanol quantities were also determined for both steady-state and transient chassis operation. CVS dilute exhaust was drawn through a sample train heated to 79°C (175°F), then through glass bubblers containing distilled water kept near 2°C in order to condense out and collect unburned methanol.[13] The level of methanol collected was determined by gas chromatograph using an FID specifically calibrated for quantitative purposes.

Although it was assumed that most of the HC measured would be associated with unburned methanol, an additional proportional bag sample of CVS-dilute exhaust was obtained for analysis of selected individual hydrocarbons (IHC). A portion of the gases collected in the bag was injected into a four-column gas chromatograph using a single FID and dual sampling valves. The timed sequence selection valves allowed the baseline separation of air, methane, ethane, ethylene, acetylene, propane, propylene, benzene, and toluene.[14]

Aldehydes and ketones were determined using the 2,4-dinitrophenylhydrazine (DNPH) method.[13] This method yields individual species of aldehydes. Dilute exhaust samples were taken from the CVS dilution tunnel. A heated Teflon sample line and filter were maintained at 190°C (375°F) (no interference from dissociation of methanol is expected while using this procedure). The procedure consists of bubbling filtered exhaust gases, dilute or raw, through glass impinger traps containing a solution of DNPH and HCl kept near 0°C. The aldehydes form their respective phenylhydrazone derivatives (precipitates). These derivatives are removed by filtration, and subsequently extracted with pentane and evaporated in a vacuum oven. The remaining dried extract, which contains the phenylhydrazone derivatives, is dissolved in a specific volume of methanol with anthracene internal standard. A portion of this dissolved extract is injected into a liquid chromatograph and analyzed using an ultraviolet detector to separate formaldehyde, acetaldehyde, acrolein, acetone, propionaldehyde, isobutyraldehyde, methylethylketone, crotonaldehyde, hexanaldyhyde, and benzaldehyde. The emission rates of these individual species are then accumulated by computation to yield total aldehyde emissions.

The transient Federal Test Procedure[12] for heavy-duty diesel engines specifies that HC emissions be determined from integration of continuous concentration monitoring of the CVS-diluted exhaust. The procedure provides the option of determining CO, CO_2, and NO_x from either dilute sample bags or integration of continuous concentration monitoring. Carbon monoxide and CO_2 levels were determined from proportional dilute exhaust bag samples. Concentrations of both gases were determined by non-dispersive infrared (NDIR) instruments. NO_x emissions were determined from both integration of continuous concentration monitoring of the CVS-diluted exhaust and bag samples, by use of a chemiluminescence (CL) instrument. NO_x correction factors for intake humidity were applied as specified in the 1984 transient FTP.[12]

Emission levels for HC, CO, CO_2 and NO_x were processed along with CVS flow parameters and bus operating parameters to compute mass emissions on the basis of distance and fuel usage. These computations were based on the equations specified in the Federal Register for exhaust emissions from gasoline or diesel exhaust.[12] These equations were modified per "Calculation of Emissions and Fuel Economy when Using Alternate Fuels" (EPA Report No. 460/3-83-009) in order to account for the use of an oxygenated fuel.[15] Using these modified equations, fuel consumption was computed on the basis of carbon balance. The fuel consumption during chassis testing was also measured using a flow meter (Flo-tron), but this method is experimental and the accuracy is unknown.

Particulate emissions were determined from dilute exhaust samples utilizing various collection media and apparatus, depending on the analysis to be performed. Particulate has been defined as any material collected on a fluorocarbon-coated glass fiber filter at or below a temperature of 51.7°C (125°F), excluding condensed water. The 51.7°C temperature limit and the absence of condensed water generally dictate that the raw exhaust be diluted, irrespective of engine operating mode. On the basis of the 51.7°C temperature limit, the CVS was run at approximately 3200 SCFM during testing of both buses.

Total particulate mass samples were collected on 47 mm Pallflex T60A20 fluorocarbon-coated glass fiber filter media, by means of a single-dilution technique. Gravimetric weight gain, representing collected particulate, was determined to the nearest microgram after the filter temperature and humidity were stabilized. This weight gain and CVS flow parameters were used to calculate the total particulate mass emissions from the bus under test. Particulate mass rate was determined for each individual test cycle in triplicate.

Metals and other elements that make up the total particulate were also of interest, so a sample of total particulate matter was also collected on a 47 mm Fluoropore filter for the determination of trace elements such as calcium, aluminum, phosphorus, and sulfur by x-ray fluorescence. This analysis was conducted at the EPA, ORD laboratories in Research Triangle Park, N.C. using a Siemens NRS-3 X-ray fluorescence spectrometer.

Diesel particulate generally contains significant quantities of condensed fuel-like or oil-like hydrocarbon aerosols generated in incomplete combustion zones. In order to determine to what extent the total bus particulate contained these various hydrocarbons, a large particulate-laden filter (20 x 20 inch) was washed with an organic solvent (methylene chloride) using 500 ml soxhlet extraction apparatus. The dissolved portion of the "total particulate" carried off with the methylene chloride solvent has been referred to as the "soluble organic fraction" (SOF). Since the total particulate emission rates were expected to be very low, filters to be used for determination of SOF were allowed to accumulate particulate over three runs of a given cycle.

The boiling point distribution of the SOF from the CBD and the bus cycle were determined by SwRI's Fuels and Lubricants Research Division using a high-temperature variation of ASTM-D2887-73. Approximately 50 mg (when available) of the SOF was dissolved in solvent and an internal standard (C_9 to C_{11} compounds) was added. This sample was then submitted for instrument analysis of boiling point distribution.

Samples of the crankcase oil were taken from each bus and analyzed for metals and boiling point distribution. The same procedures used on the particulate were used on the oil samples.

F. Quality Assurance

All work under this work assignment was conducted in accordance with the Quality Assurance Project Plan for the EPA Contract No. 68-03-3192

submitted July 1983. Results obtained from the various sampling and analysis techniques were checked and reviewed in order to eliminate potential errors in raw data, instrument reading, computer processing errors, or computations. System checks such as propane recovery checks, introduction of standard gases into instrumentation, and weigh chamber control measures were carried out in order to provide quality measurements. Unregulated chemistry samples were processed as carefully as possible during the work-up stages of the procedures, and standards were processed in order to verify proper operation of liquid and gas chromatographic instrumentation.

The overall accuracy of the emissions data obtained in this program is dependent on both the measurement accuracy and the buses being tested. Measurement accuracies for the various emissions determined in this program are given in Table 6. Since no reference bus of known emissions exists, overall accuracy is unknown.

TABLE 6. ACCURACY[a] OF EMISSION MEASUREMENTS CONDUCTED ON METHANOL-FUELED BUSES

Emission	Measurement Accuracy[b], %	Overall Accuracy, %
Total HC, bag	±15[b]	--[c]
Total HC, continuous	±15[b]	--[c]
Individual HC	±25[b]	--[c]
CO, bag	±20[b]	--[c]
CO_2, bag,[f]	±5[b]	--[c]
NO_x, bag	±10[b]	--[c]
NO_x, continuous	±10[b]	--[c]
Total Aldehyde	±25	--[c]
Indiv. Aldehyde	±25[e]	--[c]
Methanol	±25[e]	--[c]
Total Particulate	±10[b]	--[c]
Metals Content	±10	--[c]
SOF Content	±10	--[c]
SOF Boiling Pt. Dist.	unknown[d]	--[c]

[a]Accuracy is the degree of agreement of a measurement with accepted reference or true value

[b]Represents accuracy goals based on SwRI experience and SAE Technical Paper 790232

[c]Overall accuracy is unknown due to nature of the program - no reference bus exists to serve as a comparison standard for measured emission levels

[d]Accuracy is dependent on level of residue, quantity and quality of sample, etc.

[e]Accuracy is dependent on sample concentration

[f]CO_2 measurement essentially represents fuel consumption via carbon balance

Completeness of emission measurements (number of usable data points relative to number of requested data points) made during this program is given in Table 7. The reported data represent an overall completeness greater than 95 percent, and with the exception of metals and unburned methanol, all other emissions were 100 percent complete.

TABLE 7. COMPLETENESS[a] OF EMISSION MEASUREMENTS CONDUCTED ON METHANOL-FUELED BUSES

Emission	Completeness, data determined/data requested											
	Cold Idle		20 kph		40 kph		Hot Idle		CBD		Bus	
	MAN	GMC	MAN	GMC	MAN	GMC	MAN	GMC	MAN	GMC	MAN	GMC
Total HC, bag	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Total HC, continous	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Individual HC	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
CO, bag	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
CO_2 bag[b]	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
NO_x, bag	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
NO_x, continuous	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Total Aldehyde	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Indiv. Aldehyde	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Methanol	3/3	3/3	3/3	2/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Total Particulate	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Metals Content	3/3	1/0	0/0	0/0	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1
SOF Content	3/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
SOF Boiling Pt. Dist.	3/3	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/1	1/1	1/1	1/1

[a]Completeness given as number of usable data points determined per number of data points requested

[b]CO_2 measurement essentially represents fuel consumption via carbon balance

Precision or standard deviation were computed for data having triplicate determinations. For comparison purposes the standard deviation was divided by the mean value to obtain percent variation. Percent variations for most of the emissions are given in Tables 8 and 9 for the M.A.N. and GMC buses, respectively.

TABLE 8. PRECISION (AS PERCENT VARIATION) OF EMISSION MEASUREMENTS CONDUCTED ON A M.A.N. METHANOL BUS

Emission	Percent Variation (Standard Deviation/Mean), %					
	Cold Idle	20 kph	40 kph	Hot Idle	CBD	Bus
Total HC, bag	80	26	43	90	71	84
Total HC, continuous	75	13	13	26	26	40
Total IHC[b]	83	51	145	97	37	54
CO, bag	70	50	9	35	3	40
CO_2 bag[a]	4	3	1	4	1	1
NO_x, bag	20	4	3	7	4	16
NO_x, continuous	7	19	21	12	10	21
Total Aldehyde[b]	38	63	86	73	11	46
Methanol	24	34	37	140	96	21
Total Particulate	40	5	23	34	54	2
Metal Content	--[c]	--[c]	--[c]	--[c]	--[c]	--[c]
SOF Content	--[c]	--[c]	--[c]	--[c]	--[c]	--[c]
SOF Boiling Pt. Dist.	--[c]	--[c]	--[c]	--[c]	--[c]	--[c]

[a]CO_2 measurement essentially represents fuel consumption via carbon balance
[b]Percent variations of the total of the individual species determined by summing the standard error of the individual species and dividing by the total of the individual species
[c]Unknown, but is likely to be in excess of that determined for Total Particulate

TABLE 9. PRECISION (AS PERCENT VARIATION) OF EMISSIONS MEASUREMENTS CONDUCTED ON A GMC METHANOL BUS

Emission	Percent Variation (Standard Deviation/Mean), %					
	Cold Idle	20 kph	40 kph	Hot Idle	CBD	Bus
Total HC, bag	26	11	8	5	6	18
Total HC, Cont.	5	4	4	4	6	13
Total IHC[b]	39	44	48	84	27	18
CO, bag	3	2	4	5	2	2
CO_2, bag[a]	4	1	0.2	3	0.2	1
NO_x, bag	4	2	2	21	1	0.2
NO_x, continuous	8	24	5	19	2	4
Total Aldehyde[b]	42	18	11	13	38	40
Methanol	7	0	9	36	8	20
Total Particulate	15	37	26	14	4	12
Metal Content	--[c]	--[c]	--[c]	--[c]	--[c]	--[c]
SOF Content	--[c]	--[c]	--[c]	--[c]	--[c]	--[c]
SOF Boiling Pt. Dist.	--[c]	--[c]	--[c]	--[c]	--[c]	--[c]

[a]CO_2 measurement essentially represents fuel consumption via carbon balance
[b]Percent variations of the total of the individual species determined by summing the standard error of the individual species and dividing by the total of the individual species
[c]Unknown, but is likely to be in excess of that determined for Total Particulate

IV. RESULTS

This section describes the results obtained from numerous emission measurements and sample analyses conducted on the M.A.N. and GMC methanol buses. It is divided into three parts. The first part describes some of the pertinent details and the chronology of the accumulated test results. The next two parts detail accumulated regulated and unregulated emission data, respectively. Overall emission trends and general remarks are given along with the results.

A. General Test Notes

In preparation for the methanol bus test work, the CVS dilution tunnel and its associated particulate sampling systems were cleaned of accumulated diesel fuel-derived particulate. Propane recovery checks were run in order to assure that CVS volume curves were within the accuracy limit of ± 2 percent. Arrangements for bus transport were established.

The M.A.N. SU 240 was received in good condition via a drop-deck trailer. After familiarization and a check that all spark plug wires were in place, the driver started the bus according to the start-up procedures outlined in the instructions (essentially turn on the power to the fuel pumps, wait 5 seconds and start the engine with the foot throttle depressed). The M.A.N. was driven to a public scale and weighed (24,470 lb total). Overall performance of the M.A.N. methanol bus was good. Switch positions of the brake retarding systems were confirmed to be in the "OFF" position. The inertia wheels of the dynamometer were set for a simulation of 12,834 kg (28,300 lb) representing approximately 25 passengers and a driver. Total road load power at 80 kph (50 mph) was computed to be 58 kW (78 hp); 31 kW (42 hp) due to air resistance, and 27 kW (36 hp) due to rolling resistance. The dynamometer controls were adjusted to approximate the computed road load curve of the bus. The exhaust was routed to the CVS and the bus was operated over segments of the various test cycles in order to determine the CVS flow-rate required for single-dilution particulate emission determinations. A surprisingly low CVS flowrate of 3200 SCFM was adequate for single dilution of the M.A.N. exhaust. Preliminary runs were used for range finding and instrument set-up.

The sequence of testing was a cold-start idle in neutral, 20 kph, 40 kph, hot idle in drive, CBD cycle, then a bus cycle. This test sequence was carried out repeatedly over three test days. Emission samples for HC, CO, CO_2, NO_x, IHC, aldehydes, methanol and total particulate were collected or measured each day. Small particulate samples for metals and large particulate samples for SOF were accumulated or "stacked" on a single filter, used over a given cycle during all three replicates of that cycle. This accumulation was done to improve the accuracy of the SOF and metals determinations by increasing the weight-to-tare ratio. A sample of the M.A.N. bus crankcase oil was taken for analysis of metals and boiling point distribution. Cold-start of the M.A.N. methanol engine went well, and "good" engine idle quality was observed. Engine operation was "good" over all operating test conditions. The driver was able to follow both the CBD and bus cycle transient driving schedules in a satisfactory manner. After accounting for all emission samples, the M.A.N. bus was

released for return shipment by trailer. Computer printouts from emission tests run on the M.A.N. are given in Appendix A for reference.

The GMC methanol bus was received in good condition and was off-loaded from the trailer with the assistance of the local transit property (VIA Metropolitan Transit of San Antonio). After familiarization, the GMC methanol bus engine was started according to the instructions provided. The starting procedure basically called for turning on the glow plugs for approximately 1-2 minutes, then engaging the starter. If a false start was encountered, the sequence was repeated. Once the bus was started, the engine was under the control of the on-board computer and would not respond to accelerator pedal movement until after about 2 to 5 minutes. Idle quality was very rough until the engine oil warmed up. After about 15 minutes of low speed idle, engine idle quality improved. Initially the improvement in idle quality was not as good as expected, and it was determined that one of the glow plug connections was faulty. The warm idle quality improved when all the glow plugs were working properly.

The bus was weighed at the public scale (28,650 lb total), then driven back to the laboratory. Inertia wheels of the dynamometer were set for a simulation of 14,784 kg (32,600 lb), representing approximately 25 passengers with a driver. This setting was 270 kg (600 lbs) higher than desired on the basis of 21 passengers and 1 driver at 68 kg (150 lb) each, but it was necessary because the next available lower increment of inertia would have been much too low. In addition, using 14,784 kg would simulate the same passenger load as used for the M.A.N. Total road load power at 80 kph (50 mph) was computed to be 60 kW (80 hp); 29 kW (39 hp) due to air resistance and 31 kW (41 hp) due to rolling resistance. The dynamometer controls were adjusted to approximate the computed road load curve of the GMC methanol bus. With exhaust routed to the CVS, the bus was operated over all of the test cycles. Particulate sample zone temperatures were sufficiently below the 51.7°C (125°F) limit so that the CVS flow of 90 SCMM (3200 SCFM) could be used for all emission testing in this project.

The same test sequence used for the M.A.N. methanol bus was used on the GMC methanol bus. Preliminary checks of emission levels over the various test cycles indicated substantial differences between the two buses. Testing for emissions was carried out over three test days using the same procedures as used for the M.A.N. bus.

The GMC bus performed reasonably well with the exception of cold idle in neutral. Cold start-up was accomplished with no problem, and the engine did not stall. However, the idle quality was very erratic and rough for the initial 3 to 4 minutes, continuing to be rough-to-smooth intermittently until approximately 13 to 15 minutes from the time of start-up. After the 13- to 15-minute time mark, the computer control shifted air control and fuel scheduling such that the idle quality became smoother. Aside from the rough idle during warm-up, the general performance was regarded as "acceptable" by the driver. The driver was able to follow both the CBD and bus cycle transient driving schedules in a satisfactory manner.

The GMC bus was equipped with a diagnostic data link (DDL). Some of the outputs from the DDL reader were recorded during steady-state operation and are summarized in Table 10. The "pulsewidth" represents the number of crank angle degrees that the injectors are supplying fuel, and the "beginning of injection" represents the injection timing in degrees BTDC. "Injector response" represents the time taken from when the computer control requests the injector be turned on to when the injector solenoid valve actually closes. In addition, exhaust temperatures were taken from thermocouples located in the exhaust manifold port of each cylinder. Examining the individual results indicates that the engine operated consistently over the three runs made for emissions testing.

TABLE 10. GMC METHANOL BUS DIAGNOSTIC DATA LINK (DDL) READER OUTPUT[a]

Parameters	Cold Idle	20 kph	40 kph	Hot Idle
Engine, Speed, rpm	764-820	914-933	1262-1271	641-632
Compressor Pressure, kPa	47	50	54	47
Oil Temperature, °C	45-60	80	80-85	80
Air Temperature, °C	25-35	50-60	55-60	55-60
Throttle Position, counts	30	58	70	30
Pulse width, °crank	4.5-6.6	6.0-7.2	8.0-8.9	3.9-4.6
Beginning of Injection, °crank	8.0-8.3	4.3-4.4	5.9-7.5	6.8-7.0
Injector Response, ms				
1	1.14	1.14	1.13	1.15
2	1.18	1.17	1.17	1.17
3	1.18	1.19	1.19	1.19
4	1.22	1.22	1.23	1.23
5	1.12	1.12	1.12	1.12
6	1.16	1.16	1.19	1.17
Exhaust temp., °C				
1	170	208	196	145
2	196	250	286	141
3	184	218	278	150
4	170	265	318	152
5	280	363	442	244
6	187	242	238	158

[a]Observed over 3 separate runs

The data in Table 10 indicate some engine control changes made by the on-board computer to accommodate the four steady-state conditions. From the "pulsewidth" information, more fuel was injected during the cold-start idle in neutral than was injected during the hot-idle in drive. From the "beginning of injection" information, it appears that the timing of the methanol bus engine was substantially retarded from that reported by Toepel, et al during development work on the GMC methanol engine.[6]

A crankcase oil sample was taken, and after accounting for all the emission samples, the GMC methanol bus was released for return shipment by trailer. Computer printouts from emission tests run on the GMC are given in Appendix B for reference.

B. Regulated Emissions

Regulated emissions of HC, CO, NO_x and particulate were determined over four steady-state conditions and two transient tests or cycles. Results of three determinations of the regulated emissions over these six test conditions are given in Tables 11 and 12 for the M.A.N. and the GMC methanol buses, respectively. Averages of the three determinations are also given, along with computed and measured fuel consumption and the computed fuel economy figures. Emissions are tabulated on the basis of grams per unit distance and grams per unit mass of methanol fuel. In all cases, fuel specific emissions were calculated on the basis of fuel usage derived from carbon balance calculations using continuous HC, bag CO, and bag CO_2 determinations.

Total hydrocarbons were measured using a HFID calibrated on propane and having a response of 80 percent to methanol. "As-measured" hydrocarbon emissions were increased to account for the reduced response of the HFID instrument to methanol. In addition, hydrocarbon mass emissions reported here were computed using a density of 37.69 g/ft^3 for methanol with a H/C ratio of 4.0 (versus 16.33 g/ft^3 for fuel with a HC ratio of 1.85), so the weight of oxygen contained in the methanol molecule is included in the mass HC emissions reported. Hydrocarbon values were determined by both bag and continuous measurement techniques. Bag techniques are generally used with spark-ignited engines (gasoline) and continuous techniques are generally associated with compression ignition engine emissions (diesel). Generally, both techniques are applicable to these methanol fueled vehicles, and both techniques usually gave comparable information. The precision (or percent variation) values for both HC and other emissions are given in Tables 8 and 9 of the Quality Assurance section of this report.

Emissions of NO_x were also determined on the basis of bag and continuous techniques. Continuous NO_x measurements indicated lower emissions of NO_x than bag measurements which is opposite the trend usually noted for diesel NO_x emissions measurements. Extensive checks of the span gases, instrument calibrations, integrators, bag cart instruments, and data processing were made but higher NO_x levels from bag readings than from continuous readings could not be explained. The difference may be attributed to the fact that NO_x concentrations using a single dilution CVS were low relative to background levels. Carbon monoxide and carbon dioxide emissions were determined from proportional bag samples only.

Concentrations of HC and CO were very low (near background levels) for the M.A.N., making it difficult to accurately determine hydrocarbon emissions. To the other extreme, concentrations of HC and CO were very high for the GMC. Particulate emissions were based on filter weight gain. Particulate collection levels were very low for the M.A.N., and the ability to determine very small weight gains make it difficult to establish accurate particulate emissions.

On the basis of these qualifying remarks the emissions data have been reported in the Tables to three significant figures or limited to two places to the right of the decimal, with the exception of three decimal places on the particulate emissions from the M.A.N.. Similarly, fuel consumption by carbon

TABLE 11. SUMMARY OF REGULATED EMISSIONS FROM OPERATION OF M.A.N. METHANOL BUS

Emissions Test Cycle	No.	Emissions, g/km (g/kg fuel)[a] HC[f] Bag[f]	HC[f] Cont.[f]	CO Bag	NO_x Bag	NO_x Cont.	Total Part.	Fuel, kg/test Carbon Balance	Fuel, kg/test Cont. Meas.	Test Distance, km	Fuel Economy[a] ℓ/100 km (km/kg)
Cold Idle[b] In-Neutral	1	--	--	--	--	--		1.78	1.43	--	--
		(59.5)	(58.0)	(13.7)	(9.56)	(7.11)	--				
	2	--	--	--	--	--		1.81	1.56	--	--
		(11.4)	(11.9)	(2.64)	(7.78)	(6.60)	--				
	3	--	--	--	--	--		1.68	1.47	--	--
		(22.8)	(25.3)	(7.52)	(6.45)	(6.15)	--				
	Avg	--	--	--	--	--	--	1.76	1.49	--	--
		(31.2)	(31.8)	(7.96)	(7.93)	(6.62)	(0.083)[d]				
20 kph[b] Steady State	1	1.10	0.70	0.46	4.38	3.84		3.51	2.97	5.06	87.13
		(1.59)	(1.01)	(0.66)	(6.31)	(5.53)	--				(1.440)
	2	0.76	0.54	0.33	4.64	3.49		3.49	2.91	5.10	85.84
		(1.11)	(0.79)	(0.49)	(6.75)	(5.07)	--				(1.460)
	3	1.25	0.63	0.14	4.10	2.48		3.33	2.86	5.11	81.86
		(1.91)	(0.96)	(0.21)	(6.28)	(3.81)	--				(1.534)
	Avg	1.04	0.63	0.31	4.36	3.25	0.035[d]	3.44	2.91	5.09	84.94
		(1.54)	(0.93)	(0.45)	(6.45)	(4.80)	(0.051)				(1.478)
40 kph[b] Steady State	1	0.66	0.53	0.23	3.30	2.85		4.34	3.49	10.10	53.92
		(1.55)	(1.23)	(0.53)	(7.67)	(6.63)	--				(2.325)
	2	0.40	0.41	0.21	3.29	2.43		4.38	3.45	10.15	54.17
		(0.93)	(0.96)	(0.49)	(7.63)	(5.63)	--				(2.315)
	3	0.29	0.43	0.19	3.07	1.85		4.31	3.58	10.16	53.22
		(0.68)	(1.00)	(0.44)	(7.24)	(4.35)	--				(2.356)
	Avg	0.45	0.45	0.21	3.22	2.37	0.025[e]	4.34	3.51	10.14	53.77
		(1.05)	(1.06)	(0.49)	(7.51)	(5.54)	(0.058)				(2.332)

TABLE 11 (CONT'D). SUMMARY OF REGULATED EMISSIONS FROM OPERATION OF M.A.N. METHANOL BUS

Emissions Test Cycle	No.	Emissions, g/km (g/kg fuel)[a] HC[f] Bag[f]	HC[f] Cont.[f]	CO Bag	NO_x Bag	NO_x Cont.	Total Part.	Fuel, kg/test Carbon Balance	Fuel, kg/test Cont. Meas.	Test Distance, km	Fuel Economy[a] ℓ/100 km (km/kg)
Hot Idle[b]	1	--	--	--	--	--		1.83	1.62	--	--
In-Drive		(2.59)[c]	(0.85)	(0.42)	(11.5)	(10.2)	--				
	2	--	--	--	--	--		1.83	1.63	--	--
		(0.76)	(0.55)	(0.34)	(12.8)	(9.92)	--				
	3	--	--	--	--	--		1.72	1.56	--	--
		(0.48)	(0.58)	(0.20)	(13.0)	(8.11)	--				
	Avg	--	--	--	--	--	--	1.79	1.60	--	--
		(1.28)[c]	(0.65)	(0.32)	(12.4)	(9.42)	(0.113)[e]				
Central	1	1.95[c]	0.59	0.46	10.2	9.72		3.21	2.67	3.26	123.7
Business		(1.98)	(0.60)	(0.47)	(10.4)	(9.85)	--				(1.015)
District	2	0.61	0.38	0.49	10.7	8.68		3.26	2.69	3.26	125.5
(CBD)		(0.61)	(0.38)	(0.50)	(10.8)	(8.75)	--				(0.999)
	3	0.65	0.63	0.48	9.77	7.90		3.21	2.64	3.27	123.2
		(0.66)	(0.63)	(0.49)	(9.95)	(8.04)	--				(1.018)
	Avg	1.08[c]	0.53	0.48	10.3	8.79	0.063[e]	3.23	2.67	3.26	124.1
		(1.09)	(0.54)	(0.49)	(10.4)	(8.88)	(0.063)				(1.011)
Bus Cycle	1	1.61[c]	0.99	0.39	9.19	7.97		3.97	3.34	4.68	106.5
		(2.35)	(1.44)	(0.57)	(13.4)	(11.6)	--				(1.177)
	2	0.64	0.56	0.26	9.30	8.09		4.04	3.40	4.75	106.7
		(0.75)	(0.66)	(0.31)	(10.9)	(9.50)	--				(1.176)
	3	0.41	0.75	0.24	8.24	6.34		3.97	3.35	4.71	105.8
		(0.49)	(0.89)	(0.29)	(9.76)	(7.52)	--				(1.186)
	Avg	1.01[c]	0.85	0.33	9.63	8.09	0.043[e]	3.99	3.36	4.71	106.3
		(1.20)	(1.00)	(0.39)	(11.4)	(9.54)	(0.051)				(1.180)

[a] fuel specific emissions and fuel economy were computed using carbon balance fuel figures
[b] 15 minutes test duration
[c] levels indicated are likely too high and should be used with caution
[d] based on average from three runs
[e] based on average from four runs
[f] these values have been increased to account for the 0.8 response factor of the FID to methanol and are based on a molecular weight of 32

TABLE 12. SUMMARY OF REGULATED EMISSIONS FROM OPERATION OF GMC METHANOL BUS

Emissions Test Cycle	No.	Emissions, g/km (g/kg fuel)[a] HC[c] Bag[c]	HC[c] Cont.[c]	CO Bag	NO_x Bag	NO_x Cont.	Total Part.	Fuel, kg/test Carbon Balance	Fuel, kg/test Cont. Meas.	Test Distance, km	Fuel Economy[a] ℓ/100 km (km/kg)
Cold Idle[b] In-Neutral	1	--	--	--	--	--	--	3.28	2.85	--	--
		(120)	(215)	(35.4)	(1.66)	(1.60)	(0.61)				
	2	--	--	--	--	--	--	3.10	3.26	--	--
		(205)	(238)	(33.5)	(1.65)	(1.37)	(0.47)				
	3	--	--	--	--	--	--	3.37	2.84	--	--
		(184)	(235)	(33.7)	(1.78)	(1.51)	(0.49)				
	Avg	--	--	--	--	--	--	3.25	2.98	--	--
		(170)	(229)	(34.2)	(1.70)	(1.49)	(0.52)				
20 kph[b] Steady-State	1	116	146	32.3	1.61	1.04	0.46	4.37	3.82	5.09	104.71
		(135)	(171)	(37.5)	(1.88)	(1.20)	(0.54)				(1.164)
	2	138	154	31.6	1.50	1.20	0.31	4.44	3.89	5.36	102.37
		(168)	(185)	(38.2)	(1.81)	(1.44)	(0.37)				(1.208)
	3	140	158	31.6	1.60	1.31	0.21	4.42	3.88	5.16	105.89
		(162)	(184)	(36.8)	(1.86)	(1.53)	(0.25)				(1.165)
	Avg	131	152	31.8	1.57	1.32	0.33	4.41	3.86	5.20	104.32
		(155)	(180)	(37.5)	(1.85)	(1.56)	(0.39)				(1.179)
40 kph[b] Steady State	1	101	128	27.0	1.68	1.67	0.24	7.19	6.16	10.25	85.13
		(144)	(184)	(38.6)	(2.39)	(2.38)	(0.35)				(1.426)
	2	113	130	27.2	1.68	1.60	0.15	7.21	6.15	10.24	86.57
		(160)	(185)	(38.7)	(2.39)	(2.27)	(0.21)				(1.420)
	3	119	139	25.4	1.62	1.52	0.17	7.22	6.24	10.30	85.79
		(170)	(199)	(36.2)	(2.31)	(2.17)	(0.25)				(1.427)
	Avg	111	132	26.6	1.66	1.60	0.19	7.21	6.18	10.26	85.83
		(158)	(189)	(37.8)	(2.36)	(2.27)	(0.27)				(1.424)

TABLE 12 (CONT'D). SUMMARY OF REGULATED EMISSIONS FROM OPERATION OF GMC METHANOL BUS

Emissions Test Cycle	No.	Emissions, g/km (g/kg fuel)[a] HC[c] Bag[c]	HC[c] Cont.[c]	CO Bag	NO_x Bag	NO_x Cont.	Total Part.	Fuel, kg/test Carbon Balance	Fuel, kg/test Cont. Meas.	Test Distance, km	Fuel Economy[a] ℓ/100 km (km/kg)
Hot Idle[b]	1	--	--	--	--	--	--	1.67	1.51	--	--
In-Drive		(95.4)	(98.4)	(43.2)	(0.51)	(0.66)	(0.51)				
	2	--	--	--	-	--	--	1.57	1.49	--	--
		(100)	(104)	(46.1)	(0.62)	(0.56)	(0.67)				
	3	--	--	--	--	--	--	1.61	1.48	--	--
		(90.0)	(105)	(47.2)	(0.78)	(0.45)	(0.56)				
	Avg	--	--	--	--	--	--	1.62	1.49	--	--
		(95.1)	(103)	(45.5)	(0.64)	(0.56)	(0.58)				
Central	1	54.5	75.6	56.3	5.21	4.82	0.94	4.70	4.01	3.31	176.3
Business		(38.2)	(53.1)	(39.6)	(3.66)	(3.39)	(0.66)				(0.704)
District	2	58.4	70.0	52.9	5.19	4.96	0.96	4.72	4.07	3.39	173.4
(CBD)		(42.0)	(50.2)	(38.0)	(3.73)	(3.56)	(0.69)				(0.718)
	3	60.5	79.5	55.3	5.19	4.88	0.99	4.70	4.06	3.36	173.5
		(43.2)	(56.9)	(39.6)	(3.71)	(3.49)	(0.71)				(0.716)
	Avg	57.8	75.0	54.9	5.20	4.89	0.96	4.71	4.05	3.35	174.4
		(41.1)	(53.4)	(39.1)	(3.70)	(3.48)	(0.69)				(0.713)
Bus Cycle	1	64.4	81.8	78.9	5.66	5.01	0.35	7.57	6.41	4.84	194.3
		(41.1)	(52.2)	(50.6)	(3.62)	(3.20)	(0.22)				(0.639)
	2	89.5	92.5	78.9	5.46	4.66	0.41	7.42	6.37	4.92	188.8
		(59.5)	(61.4)	(52.3)	(3.62)	(3.09)	(0.27)				(0.663)
	3	79.8	104	76.4	5.50	5.08	0.42	7.59	6.47	4.98	188.6
		(52.2)	(68.1)	(50.1)	(3.61)	(3.33)	(0.27)				(0.656)
	Avg	77.9	92.6	78.1	5.54	4.92	0.39	7.53	6.42	4.91	190.6
		(51.0)	(60.6)	(51.0)	(3.62)	(3.21)	(0.25)				(0.653)

[a]Fuel specific emissions and fuel economy were computed using carbon balance fuel figures

[b]15 minutes test duration

[c]these values have been increased to account for the 0.8 response factor of the FID to methanol and are based on a HC molecular weight of 32

balance and test distance were used to compute fuel economy, which is reported to four significant figures to allow more complete conversion of emissions from one set of units to another. Computer printouts from all the gaseous emission tests compiled in Tables 11 and 12 are given in Appendices A and B for the M.A.N. and the GMC methanol buses, respectively. A summary of the averages from Tables 11 and 12 is given in Table 13.

TABLE 13. SUMMARY OF METHANOL FUEL SPECIFIC EMISSIONS FROM THE M.A.N. AND GMC METHANOL BUSES

Test Cycle	Bus Types	Emissions, g/kg fuel[e]						Fuel Economy[e]	
		HC[a,f]	HC[b,f]	CO	NO_x[a]	NO_x[b]	Part.	kg/test	km/kg
Cold Idle[c,d] In-Neutral	M.A.N.	31.2	31.8	7.96	7.93	6.62	0.08	1.76	--
	GMC	170	229	35.2	1.70	1.49	0.52	3.25	--
20 kph[c] Steady-State	M.A.N.	1.54	0.93	0.45	6.45	4.80	0.05	3.44	1.48
	GMC	155	180	37.5	1.85	1.56	0.39	4.41	1.18
40 kph[c] Steady-State	M.A.N.	1.05	1.06	0.49	7.51	5.54	0.06	4.34	2.33
	GMC	158	189	37.8	2.36	2.27	0.27	7.21	1.42
Hot Idle[c] In-Drive	M.A.N.	1.28	0.65	0.32	12.4	9.42	0.11	1.79	--
	GMC	95.1	103	45.5	0.64	0.56	0.58	1.62	--
CBD	M.A.N.	1.09	0.54	0.49	10.4	8.88	0.06	3.23	1.01
	GMC	41.1	53.4	39.1	3.70	3.48	0.69	4.71	0.71
Bus	M.A.N.	1.20	1.00	0.39	11.4	9.54	0.05	3.99	1.18
	GMC	51.0	60.6	51.0	3.62	3.21	0.25	7.53	0.65

[a] bag basis measurement
[b] continuous basis measurement
[c] 15 minutes test duration
[d] includes start-up
[e] fuel and fuel specific emissions computed on the basis of carbon balance fuel figure
[f] these values have been increased to account for the 0.8 response factor of the FID to methanol and are based on a HC molecular weight of 32

Cold idle emissions included engine start-up and low-speed idle operation with the transmission in neutral for a total of 15 minutes. The engine was not speeded up or operated at fast idle, and no attempt to cause a fast warm-up was made. For both buses HC levels were relatively high for a short-time (1-3 minutes) after start-up, then tapered off and stabilized. On the basis of HC levels obtained over other operating conditions of the M.A.N., it appears that the catalyst was not functioning during the cold idle. Even so, cold idle emission levels of HC, CO, and particulate from the M.A.N. were significantly lower than for the GMC bus.

Examining the continuous HC trace from the GMC during cold idle, HC was very high during the initial 2 to 5 minutes after engine start, when the engine idled very roughly. The HC level began tapering down to about half the initial peak level, and it held stable for the remainder of 13 to 15 minutes, coinciding with improved but still somewhat erratic idle quality. After 13 to 15 minutes the idle quality smoothed and the HC level dropped again. These changes in HC levels were noted to correspond with changes in engine operation controlled by the on-board computer modifying fuel scheduling, scavenging air throttling, and engine rpm. The high levels of HC emitted by the GMC (6 times those from the M.A.N.) during the cold idle represent a significant portion (about 20 percent) of the fuel consumed. In addition, very low emissions of NO_x from the GMC during cold idle operation were likely due to poor combustion.

Cold idle particulate emissions for the M.A.N. were very low. Cold idle particulate levels for the GMC were low compared to a diesel powered bus, but not near the low levels expected of an engine that consumes neat methanol. It is likely that engine lubricating oil was scavenged out into the exhaust and caused the higher-than-anticipated particulate emissions. After completing cold idle emissions testing, the buses were operated for 5 to 10 minutes at speeds from 20 to 50 kph in order to fully warm up the engines for the remaining tests.

Emission results from warm engine testing of the M.A.N. and GMC were significantly different from cold idle testing. Hydrocarbon emission levels from warm engine testing of the M.A.N. were very low at about 1 g/kg fuel, or less than 1 g/km. Carbon monoxide emissions were essentially negligible. Low levels of both HC and CO indicate that the engine/catalyst package was working well. It should be noted that emissions during the hot idle in "drive" were stable, and indicated the catalyst continued to steadily function for a relatively long idle period. Emissions of NO_x from the M.A.N. over all test operation ranged from 4.8 to 11 g/kg fuel, or 3.3 to 8.8 g/km. These levels were in the same range as noted for the M.A.N. D2566 FMUH methanol engine tested on behalf of EPA by SwRI in 1982. Particulate emissions from the M.A.N. over all test operation were very low, ranging from 0.05 to 0.11 g/kg fuel, or 0.02 to 0.06 g/km. These particulate levels compare well to the 0.08 g/kg fuel obtained during engine dynamometer transient testing of the M.A.N. engine in 1982.[5]

Fuel economy of the M.A.N. ranged from 1.01 to 2.33 km/kg of methanol. The M.A.N. bus has been road tested for fuel economy as reported in Reference 3 by Jackson, et al. Jackson reported fuel economy values of 10.17 and 4.56 miles per equivalent diesel gallon for the M.A.N. methanol bus for 40 kph (25 mph) steady-state and CBD operation, respectively. These values, convert to 2.36 and 1.06 km/kg of methanol, agreeing well with values of 2.33 and 1.01 km/kg of methanol determined for 40 kph steady-state and CBD operation on the dynamometer in this program.

Hydrocarbon emission levels from warm engine testing of the GMC methanol bus were very high compared to the M.A.N. The GMC methanol bus does not utilize a catalyst for exhaust aftertreatment. HC emissions for the GMC appear to be influenced by load on the engine. The light load conditions of cold idle, 20 kph, and 40 kph all had notably higher levels of HC than the hot

idle in "drive", bus cycle or CBD cycle. Considering that the HC emissions are unburned methanol, the emission levels given in Table 12 represent about 6 percent of the fuel during transient operation, and 10 to 23 percent of the fuel during some steady-state modes. Carbon monoxide from warm engine operation of the GMC methanol bus ranged from 37 to 51 g/kg fuel. Warm engine emissions of NO_x were extremely low for the GMC bus, and ranging from 0.6 to 3.7 g/kg fuel. Lower NO_x emissions is one of the claimed benefits for using methanol. However, low NO_x emissions can also be indicative of poor combustion quality.

Particulate emission from the GMC methanol bus were low, ranging from 0.25 to 0.69 g/kg of methanol. The cold idle, hot idle and CBD had higher particulate emission levels than the 20 kph, 40 kph, and bus cycle operations. Engine oil is assumed to account for the majority of these particulate emissions. Particulate sample filters appeared to have a slight gray tint after use with the GMC methanol bus.

Characteristics of this two-stroke engine allow a certain amount of engine oil to be scavanged out into the exhaust. During prolonged idle, oil can accumulate in the air box. Much of this oil accumulation is emitted during moderate to hard accelerations as condensible hydrocarbons, which can be collected as total particulate and often are included as part of the soluble organic fraction (SOF). The CBD cycle alternately calls for idle, then acceleration to 32 kph (20 mph). The bus cycle contains much idle and few accelerations during the early portions of the test, but little idle and many accelerations in the latter portion. The differences between these two transient cycles may explain the higher particulate emissions for the CBD than for the bus cycle.

Visible smoke was not measured during this program mainly because no smoke emissions were expected. However, in observing the GMC methanol bus enroute to the loading point, low levels of visible smoke were noticed. The smoke levels were judged to be near 5 percent opacity, and were noted for a brief time (1 to 2 seconds) whenever the bus accelerated from a stop. No other visible smoke was noted from either methanol bus.

Fuel consumption of the GMC methanol bus was greater than for the M.A.N. over all the conditions tested, especially at the cold idle condition, which appears to utilize a fuel enrichment mode. Jackson, et. al[3] reported a fuel economy of 8.17 and 3.22 miles per equivalent diesel gallon for the GMC methanol bus operated over the road at 40 kph and on the CBD cycle, respectively. These values, convert to 1.90 and 0.75 km/kg of methanol, comparing fairly well to 1.48 and 0.71 km/kg of methanol measured in this program for corresponding operation on the dynamometer. Values for the GMC bus reported in Reference 3 were obtained in December of 1983. Since that time, the GMC methanol bus has undergone several engine/control modifications along with mileage accumulation.

C. Unregulated Emissions

The other emissions measured in this program are currently considered unregulated emissions and include unburned methanol, aldehydes, selected

individual hydrocarbons, and the soluble organic fraction (SOF) of the total particulate. Selected samples of the total particulate were analyzed for elemental content and the boiling point distribution of the soluble organic fraction (SOF) of the total particulate was determined. Analyses for elemental content and boiling point distribution of the crankcase oil from both buses were also conducted for comparison to the characteristics of the total particulate and its soluble fraction.

Results from determinations of unburned methanol emissions from both buses over the six operating conditions are given in Table 14. Unburned methanol emissions essentially are the hydrocarbon emissions for the methanol fueled buses. If unburned methanol emissions, given in Table 14, are multiplied by 0.8, (based on the response of FID to methanol) the resulting levels compare quite well to those reported as HC emissions in Table 13. Similarly, the points discussed for the HC emissions apply to the unburned methanol emissions. Over the cold-start idle, both buses have high unburned methanol emissions relative to their emissions over the warm engine operating modes. The highest average level of unburned methanol emitted for the M.A.N. was 33,000 mg/kg of methanol, representing 3.3 percent of the fuel consumed. Over the warm engine operating conditions of the M.A.N., where the catalyst was known to be working, the levels were substantially lower. For the GMC, the highest level of 210,000 mg/kg of fuel (or 0.21 kg/kg of fuel) was found over the cold idle condition representing 21 percent of the fuel consumed. Levels of 4.4 to 5.8 percent of the fuel supplied were emitted by the GMC over the hot idle, CBD and bus cycle operation. About 17 percent of the fuel supplied was emitted during the 20 and 40 kph cruise conditions.

Other hydrocarbon emissions were measured as individual hydrocarbons, described in the analytical procedure section of this report. Results from these determinations are given in Tables 15 and 16 for the M.A.N. and GMC methanol buses, respectively. For the M.A.N., methane was the predominant individual hydrocarbon emitted; and it was greatest during the cold-idle. Methane was also noted to a lesser extent over the CBD, 20 kph and bus cycle operations, Small concentrations of ethane were noted along with an indication that ethylene and propane may be present over some conditions.

For the GMC, methane was also the predominant individual hydrocarbon found. Methane emissions were greatest during the bus and CBD cycles. Levels of methane were all near 100 mg/kg for the other test conditions, even the cold idle. A greater variety of selected individual hydrocarbons, including ethylene, ethane and toluene, were noted for the GMC. These more complex species, relative to methane, may be associated with crankcase oils entering into the combustion process with the neat methanol. Ethylene emissions for the GMC over the six test conditions averaged about 46 mg/kg fuel with the highest levels noted for the hot idle and the CBD. Lesser levels of ethane, propane, propylene, benzene, and toluene were found, but the variabilities for those determinations were relatively high, indicating only that these species may be present over some conditions.

Individual aldehydes were determined using the DNPH procedure. Tables 17 and 18 summarize the individual aldehyde emissions for the M.A.N. and the GMC methanol buses, respectively. "Total aldehydes" were obtained by adding

TABLE 14. SUMMARY OF UNBURNED METHANOL EMISSIONS FROM THE M.A.N. AND GMC METHANOL BUSES

		M.A.N.		GMC	
Cycle	Test	mg/km	mg/kg fuel[a]	mg/km	mg/kg fuel[a]
Cold Idle	1	--	38000	--	190000
In-Neutral	2	--	b	--	210000
	3	--	27000	--	220000
	Avg	--	33000	--	210000
20 kph	1	2300	3300	b	b
Steady-State	2	1300	1900	140000	170000
	3	1300	1900	140000	170000
	Avg	1600	2400	110000	170000
40 kph	1	350	820	110000	160000
Steady-State	2	700	1600	120000	170000
	3	430	1000	130000	190000
	Avg	490	1100	120000	170000
Hot-Idle	1	--	3100	--	82000
In-Drive	2	--	48[d]	--	42000[c]
	3	--	450	--	50000[c]
	Avg	--	1200	--	58000
Central	1	680	690	67000	47000
Business	2	26	26[d]	63000	45000
District	3	370	380	55000	40000
Transient	Avg	350/563	360	62000/100000	44000
Bus Cycle	1	910	1100	65000	42000
Transient	2	1000	1700	87000	58000
	3	1300	1600	94000	62000
	Avg	1100	1500	82000	54000

[a]Fuel specific emissions computed on the basis of carbon balance fuel consumption
[b]Result voided, based on measured HC levels
[c]Value obtained was significantly lower than expected but approaches the level of measured HC levels, therefore the value was used in the average
[d]Value taken as zero and included in average

TABLE 15. SUMMARY OF INDIVIDUAL HYDROCARBON EMISSIONS FROM OPERATION OF M.A.N. METHANOL BUS

Aldehyde	Test	Cold Idle In-Neutral		20 kph Steady-State		40 kph Steady-State		Hot-Idle In-Drive		Central Business District Transient		Bus Cycle Transient	
		mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel
Methane	1	--	170	42	60	1.2	2.9	--	a	80	80	32	38
	2	--	74	24	35	a	a	--	a	51	51	18	22
	3	--	66	62	94	4.6	11	--	a	110	110	19	22
	Avg	--	100	42	63	1.9	4.6	--	a	79/127	80	23	27
Ethylene	1	--	41	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	14	a	a	a	a	--	a	a	a	a	a
Ethane	1	--	a	a	a	a	a	--	a	0.3	0.3	a	a
	2	--	32	a	a	4.7	11	--	11	a	a	14	14
	3	--	a	4.1	6.3	0.3	0.6	--	6.3	a	a	0.5	0.6
	Avg	--	11	1.4	2.1	1.7	3.8	--	5.7	0.1/6.2	0.1	4.7	4.9
Propane	1	--	a	a	a	1.2	2.7	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	0.4	0.9	--	a	a	a	a	a
Total of Average		--	120	43	65	4.0	9.3	--	5.7	79/127	80	28	32

[a]Below the detection limit, taken as zero

TABLE 16. SUMMARY OF INDIVIDUAL HYDROCARBON EMISSIONS FROM OPERATION OF GMC METHANOL BUS

Aldehyde	Test	Cold Idle In-Neutral		20 kph Steady-State		40 kph Steady-State		Hot-Idle In-Drive		Central Business District Transient		Bus Cycle Transient	
		mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel
Methane	1	--	160	100	120	89	130	--	66	390	270	700	450
	2	--	120	130	160	75	100	--	a	380	270	640	420
	3	--	97	110	130	69	98	--	180	580	410	850	560
	Avg	--	120	120	140	77	110	--	81	450/724	320	730	480
Ethylene	1	--	54	30	34	15	21	--	96	82	57	72	46
	2	--	46	18	22	a	a	--	68	82	59	69	46
	3	--	40	24	28	7.9	11	--	83	100	72	59	39
	Avg	--	47	24	28	7.5	11	--	82	88/142	63	67	44
Ethane	1	--	3.2	2.1	2.5	0.2	0.3	--	a	a	a	0.7	0.4
	2	--	0.5	a	a	11	16	--	a	7.7	5.5	3.1	2.1
	3	--	0.4	a	a	6.4	9.1	--	12	18	13	25	17
	Avg	--	1.4	0.7	0.8	6.0	8.5	--	4.0	8.6/13.8	6.2	9.7	6.4
Propane	1	--	a	16	19	12	17	--	a	a	a	a	a
	2	--	a	a	a	a	--	--	94	a	a	a	a
	3	--	12	a	a	8.9	13	--	75	a	a	a	a
	Avg	--	3.9	5.5	6.4	6.9	10	--	57	a	a	a	a
Propylene	1	--	a	a	a	a	a	--	a	43	30	a	a
	2	--	a	a	a	a	a	--	a	37	26	a	a
	3	--	a	a	a	a	a	--	a	43	30	a	a
	Avg	--	a	a	a	a	a	--	a	41/66	29	a	a
Benzene	1	--	a	11	13	a	a	--	a	12	8.2	a	a
	2	--	a	a	a	a	a	--	a	19	13	a	a
	3	--	a	a	a	12	17	--	a	29	20	a	a
	Avg	--	a	3.8	4.4	4.0	5.7	--	a	20/32	14	a	a
Toluene	1	--	a	a	a	27	39	--	a	a	a	a	a
	2	--	110	60	73	a	a	--	a	41	29	34	22
	3	--	64	a	a	a	a	--	83	45	32	a	a
	Avg	--	58	20	24	8.9	14	--	28	29/47	21	11	7.4
Total of Averages		--	230	170	200	110	160	--	250	600/966	450	820	540

[a]Below the detection limit, taken to be zero

TABLE 17. SUMMARY OF ALDEHYDE EMISSIONS FROM OPERATION OF M.A.N. METHANOL BUS

Aldehyde	Test	Cold Idle In-Neutral		20 kph Steady-State		40 kph Steady-State		Hot-Idle In-Drive		Central Business District Transient		Bus Cycle Transient	
		mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel
Formaldehyde	1	--	2100	320	460	4.4	10	--	550	90	91	51	59
	2	--	1200	130	190	50	120	--	200	110	100	75	87
	3	--	2700	100	160	63	150	--	170	100	110	120	140
	Avg	--	2000	180	270	39	92	--	300	100 /161	100	82	96
Acetaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Acrolein	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Acetone	1	--	a	2.0	2.9	a	a	--	a	a	a	5.6	6.6
	2	--	a	14	20	a	a	--	12	0.6	0.6	a	a
	3	--	a	a	a	a	a	--	a	a /0.3	a	a	a
	Avg	--	a	5.2	7.5	a	a	--	4.1	0.2	0.2	1.9	2.2
Propionaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Crotonaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Isobutyraldehyde + Methyl-ethylketone	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Benzaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Hexanaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	a	a	a	a	a	--	a	a	a	a	a
Total of Average		--	2000	180	280	39	92	--	300	100	100	84	98

[a]Below the detection limit, taken as zero

TABLE 18. SUMMARY OF ALDEHYDE EMISSIONS FROM OPERATION OF GMC METHANOL BUS

Aldehyde	Test	Cold Idle In-Neutral		20 kph Steady-State		40 kph Steady-State		Hot-Idle In-Drive		Central Business District Transient		Bus Cycle Transient	
		mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel	mg/km	mg/kg fuel
Formaldehyde	1	--	2800	2700	3100	1200	1700	--	3500	750	530	1000	650
	2	--	3500	2400	2900	1300	1900	--	3000	1200	850	1700	1100
	3	--	1500	2000	2300	1100	1600	--	3800	1400	1000	2100	1400
	Avg	--	2600	2400	2800	1200	1700	--	3400	1100/1770	800	1600	1000
Acetaldehyde	1	--	49	32	38	0.9	1.3	--	53	35	25	54	35
	2	--	78	a	a	4.5	6.4	--	80	15	11	25	17
	3	--	230	95	110	30	42	--	95	120	87	150	99
	Avg	--	120	42	49	12	17	--	76	57/72	41	77	50
Acrolein	1	--	5.3	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	1.8	a	a	a	a	--	a	a	a	a	a
Acetone	1	--	25	13	16	8.5	12	--	54	38	27	39	25
	2	--	13	7.9	9.6	5.0	7.1	--	22	40	29	25	17
	3	--	a	a	a	a	a	--	a	a	a	a	a
	Avg	--	13	7.1	8.4	4.5	6.4	--	25	26/42	19	21	14
Propionaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	6.4	7.7	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	a	a	8.7	5.6
	Avg	--	a	2.1	2.6	a	a	--	a	a	a	2.9	1.9
Crotonaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	7.2	5.1	3.5	2.3
	Avg	--	a	a	a	a	a	--	a	2.4/3.9	1.7	1.2	0.8
Isobutyraldehyde + Methyl-ethylketone	1	--	a	a	a	a	a	--	a	8.8	6.2	a	a
	2	--	a	4.2	5.1	a	a	--	a	18	13	a	a
	3	--	a	a	a	1.1	1.6	--	a	68	49	6.8	4.5
	Avg	--	a	1.4	1.7	0.4	0.5	--	a	32/51	23	2.3	1.5
Benzaldehyde	1	--	10	8.9	10	a	a	--	a	a	a	a	a
	2	--	a	a	a	9.5	14	--	a	17	12	a	a
	3	--	11	36	42	2.3	3.3	--	a	24	17	6.0	4.0
	Avg	--	7.1	15	18	3.9	5.8	--	a	14/23	10	2.0	1.3
Hexanaldehyde	1	--	a	a	a	a	a	--	a	a	a	a	a
	2	--	a	a	a	a	a	--	a	a	a	a	a
	3	--	a	a	a	a	a	--	a	6.3	4.5	a	a
	Avg	--	a	a	a	a	a	--	a	2.1/3.8	1.5	a	a
Total of Average		--	2700	2400	2900	1200	1800	--	3500	1200/1931	890	1700	1100

[a]Below the detection limit, taken as zero

7/mile

the levels determined for the individual aldehydes. Formaldehyde was the predominant individual aldehyde emission for both the M.A.N. and the GMC buses, essentially representing the "total aldehydes", especially in the case of the M.A.N. bus. Some low levels of acetone emissions were noted during testing of the M.A.N. For the M.A.N., cold idle produced the highest average emission of 2000 mg formaldehyde/kg of fuel. With warm engine/catalyst, the levels of total aldehydes ranged from 200 to 92 mg/kg fuel over all other test operation for the M.A.N.

For the GMC, hot idle produced the highest average emission of 3400 mg formaldehyde/kg of fuel. Formaldehyde and the "total aldehydes" emission levels were greatest for the GMC at hot idle operation, followed by lesser amounts for the 20 kph, cold-idle, 40 kph, then transient operation. Acetaldehyde was noted along with lesser levels of acetone, benzaldehyde, and isobutyraldehyde and MEK as a group. A few other species of aldehydes and acrolein were noted, but the variability of their determination was very high. The greater number of species noted for the GMC methanol bus is likely attributed to engine crankcase oil entering into combustion.

Large 20x20 inch filters were used to collect samples of total particulate for extraction of the soluble organic fraction (SOF) of the total particulate with methylene chloride. In all cases, a given filter was used over all three replicate runs of a given cycle or steady-state condition. Since particulate emissions from both buses were minimal, the background contribution to SOF from several blank filters were determined. SOF emission results were corrected for this background contribution. The resulting SOF levels for both buses are given in Table 19. For the M.A.N., the SOF portion of the total particulate accounted

TABLE 19. SUMMARY OF SOLUBLE ORGANIC FRACTION (SOF) FROM OPERATION OF THE M.A.N. AND GMC METHANOL BUSES

Test Cycle	SOF from M.A.N.[d]			SOF from GMC[d]		
	%	g/km g/mile	g/kg fuel[c]	%	g/km g/mile	g/kg fuel[c]
Cold Idle[a,b] In-Neutral	98.3	--	0.082	85.4	--	0.44
20 kph[a] Steady-State	19.3	0.0067 / 0.0108	0.0098	84.5	0.28 / 0.45	0.33
40 kph[a] Steady-State	33.2	0.0083 / 0.0136	0.019	81.8	0.16 / 0.26	0.22
Hot Idle[a] In-Drive	10.5	--	0.012	80.9	--	0.47
CBD	34.4	0.022 / 0.35	0.022	87.2	0.84 / 1.35	0.60
Bus	49.7	0.021 / 0.34	0.025	84.9	0.33 / 0.53	0.21

[a]15 minutes
[b]Includes start-up
[c]Fuel specific emissions computed on the basis of carbon balance fuel figure
[d]Based on particulate collected over 3 tests

km = 1.609344 x miles

for essentially all of the particulate emissions during the cold idle condition. For warm engine/catalyst operation of the M.A.N., the SOF ranged from about 10 to 50 percent of the total particulate. These soluble percentages coupled with low total particulate levels yield very low fuel specific emissions of SOF. For the GMC with no catalyst aftertreatment, the soluble portion of the total particulate ranged from 80 to 90 percent over all test operation.

High temperature boiling point distributions of the SOF and oil samples from both buses were obtained, using an internal standard for quantitative purposes. The boiling point distribution of the SOF from the CBD and bus cycle particulate along with that of the crankcase oil for the M.A.N. are given in Figures 9, 10 and 11, respectively. Corresponding boiling point distributions for the GMC bus are given in Figures 12, 13, and 14. The retention times are shown on the horizontal axis in minutes and correspond to programmed temperature simulation. The peaks shown before 15 minutes retention time represent the presence of the internal standard. Peak heights shown in the figures have been normalized and are of no quantitative value, except for data storage and manipulation for graphics.

Chromatograms of SOF from CBD and bus cycle operation of the M.A.N. (Figures 9 and 10) appear to be very similar in characteristic shape with the maximum distillation rate occurring at about 26 minutes, coincident with retention times of C_{32} to C_{36} normal paraffins. In addition, both chromatograms have similarities between 20 and 24 minutes (coincident with retention times of hydrocarbons from C_{20} to C_{28}). The M.A.N. engine oil chromatogram (Figure 11) has a single maximum between 24 and 30 minutes, about the same as retention times of C_{28} to C_{50} hydrocarbons. The maximum for the oil sample occurs at 26 minutes, the same as noted for the SOF. It is likely that there would be even more similarity of chromatograms, but the M.A.N. catalyst probably breaks down some of the long chain oil molecules, causing the lower-boiling material found in the SOF from the M.A.N.

Chromatograms of SOF from CBD and bus cycle operation of the GMC (Figures 12 and 13) are essentially identical, and both are very similar to the chromatogram of the GMC lube oil (Figure 14). For all three samples, the retention times of the materials ranged from 21 to 28 minutes, coincident with those of normal paraffins C_{20} to C_{40}. The maximum distillation rates of all three chromatograms appear at approximately 25 minutes, about the same as for a C_{30} molecule. Based on these similarities, the SOF from the GMC methanol bus appears to be mostly engine oil.

Elemental analyses of the total particulate from selected test conditions and crankcase oil of both buses were performed by EPA-RTP. Results from these analyses are given in Table 20 for the M.A.N. and in Table 21 for the GMC.

Crankcase oil samples from the two buses contained similar levels of Ca, Cu, Cr, and Fe. Oil from the GMC bus contained measurable levels of Cl and Mg; whereas, the M.A.N. oil did not. The oil from the M.A.N. contained lower levels of P and Zn than noted for GMC oil, but it contained about 1.7 times the S level.

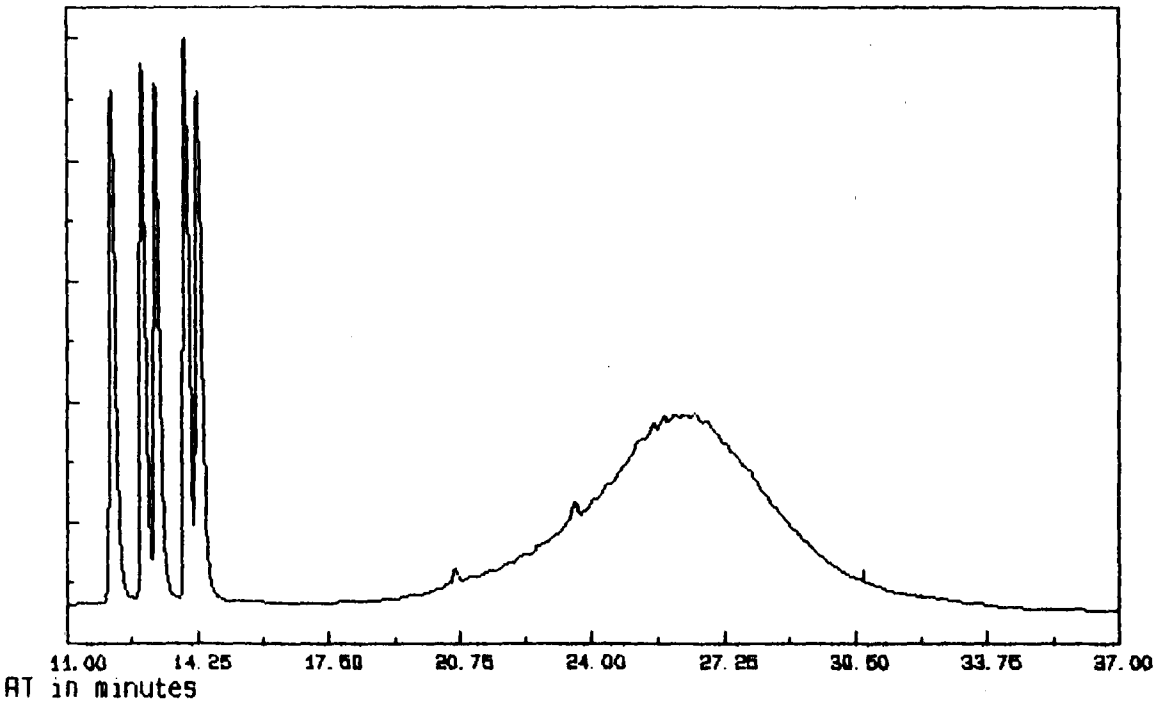

Figure 9. Boiling point distribution of SOF from bus cycle operation of the M.A.N. methanol bus (with internal std.)

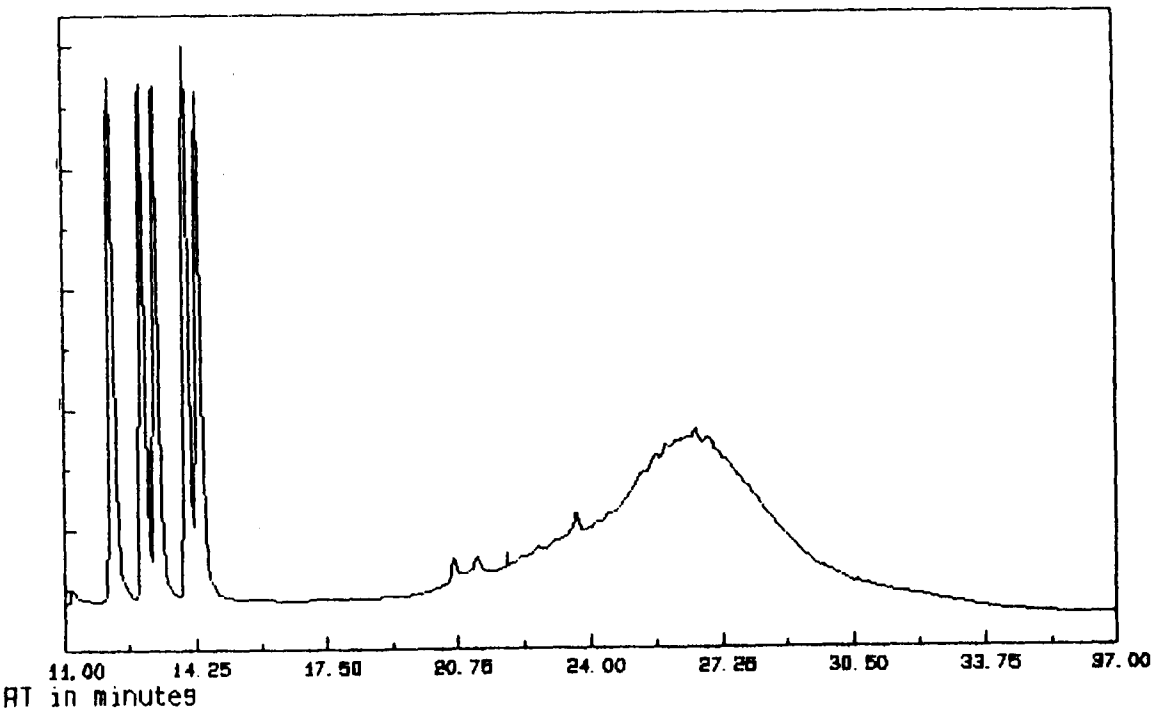

Figure 10. Boiling point distribution of SOF from CBD operation of the M.A.N. methanol bus (with internal std.)

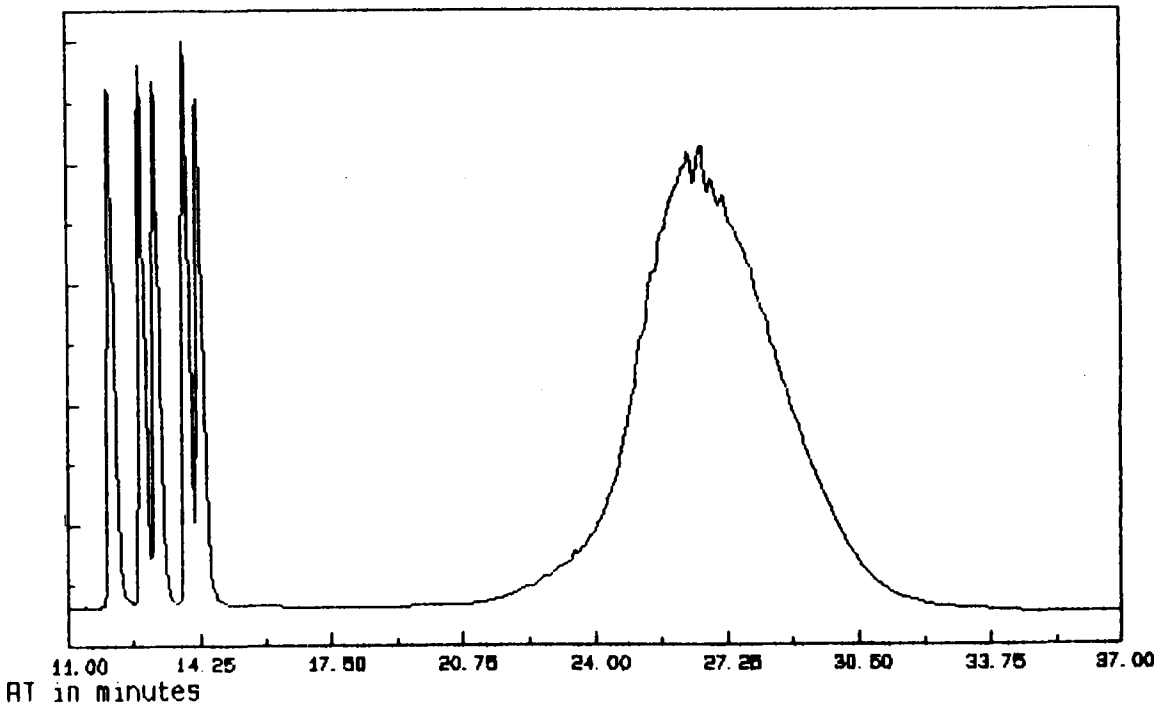

Figure 11. Boiling point distribution of oil from the M.A.N. methanol bus (with internal std.)

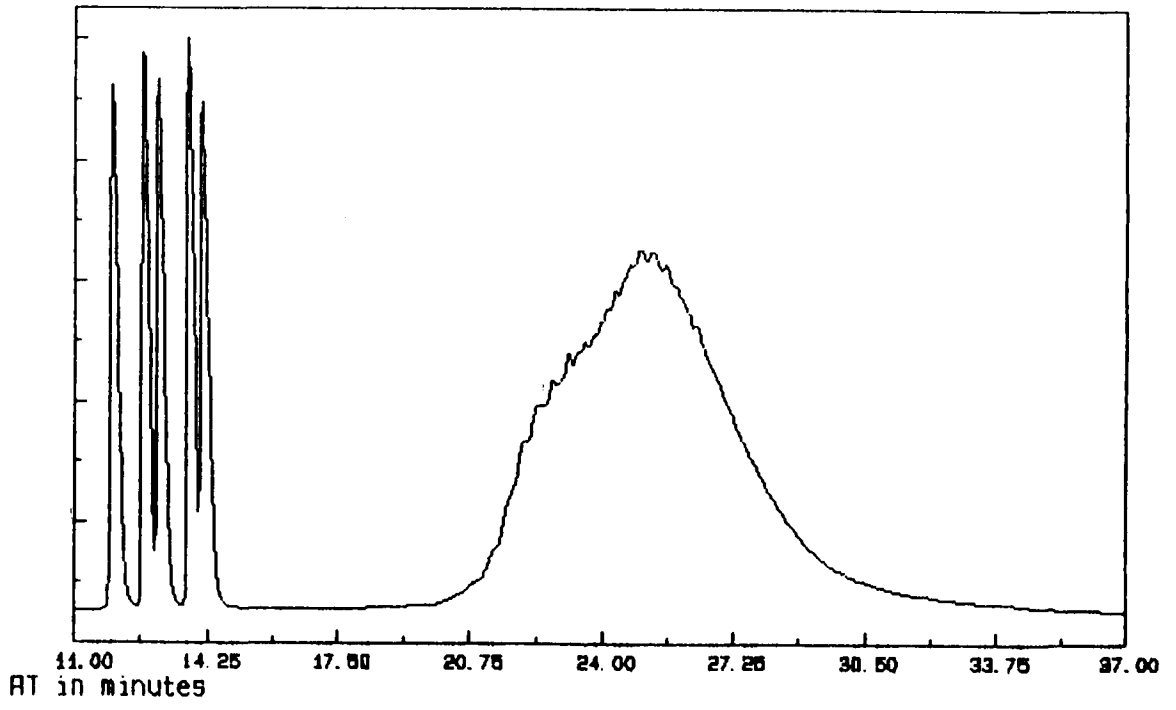

Figure 12. Boiling point distribution of SOF from CBD operation of the GMC methanol bus (with internal std.)

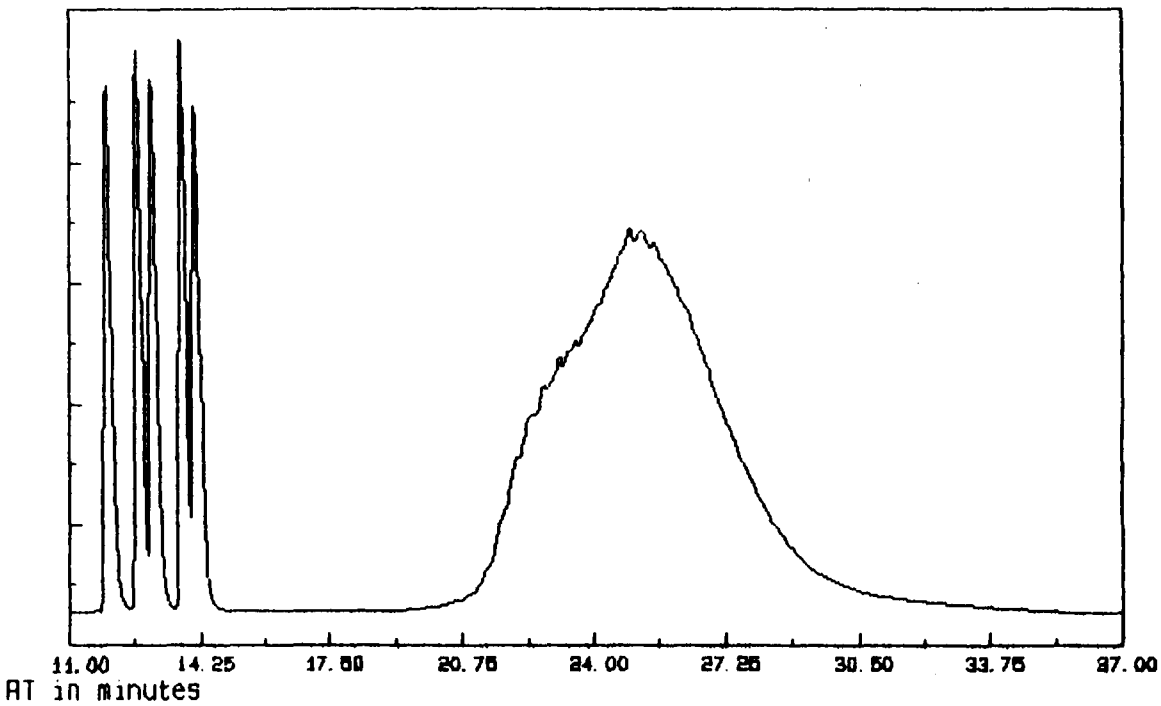

Figure 13. Boiling point distribution of SOF from bus cycle operation of the GMC methanol bus (with internal std.)

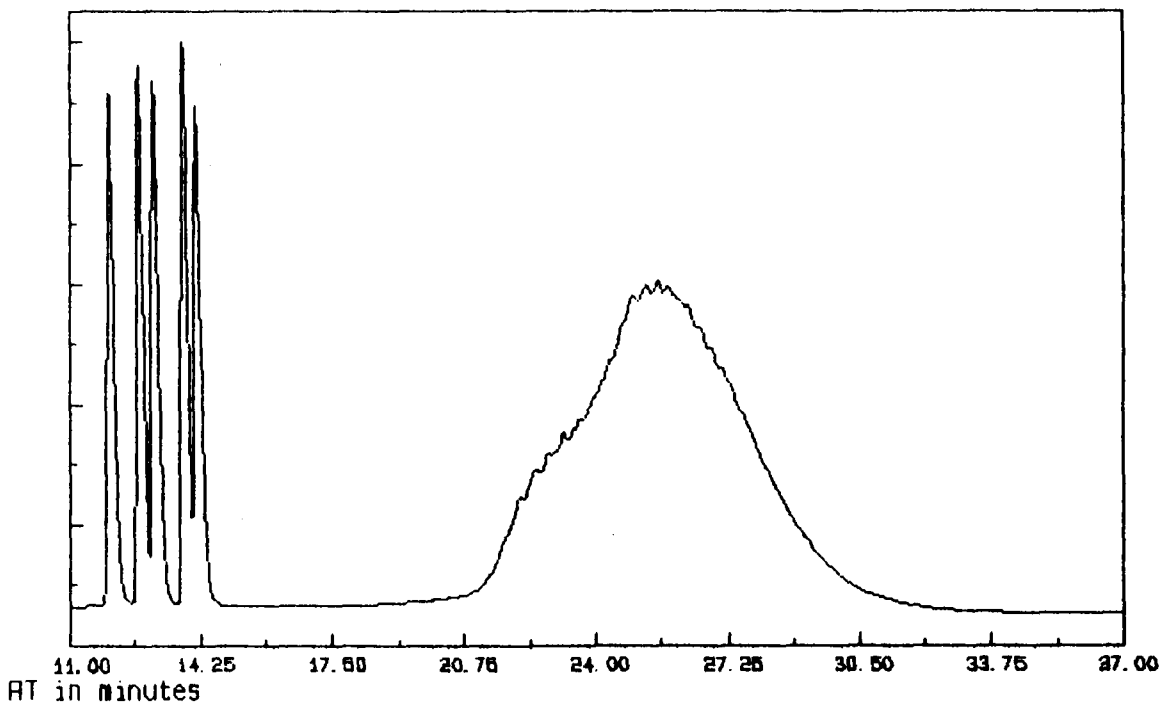

Figure 14. Boiling point distribution of oil from the GMC methanol bus (with internal std.)

TABLE 20. SUMMARY OF ELEMENTAL ANALYSIS OF CRANKCASE OIL AND TOTAL PARTICULATE FROM THE M.A.N. METHANOL BUS

Individual Elements	Crankcase Oil, ppm	Detection Limit, ppm	Total Particulate, wt. %				Detection[c] Limit, wt.%
			Cold Idle	40 kph	CBD	Bus Cycle	
Al	a	70	0.218	0.258	0.134	0.395	0.042
As	a	7	a	b	a	a	0.51
Ba	a	2	a	a	a	a	0.16
Br	a	7	a	a	a	a	0.95
Ca	1340	1	0.838	1.56	1.28	1.56	0.030
Cd	b	1	0.078	b	a	a	0.027
Cl	a	16	0.436	a	a	a	0.14
Co	a	4	a	a	a	a	0.32
Cu	13	4	1.27	2.33	1.40	b	0.35
Cr	13	4	b	a	b	b	0.60
Fe	54	4	3.31	4.52	3.31	4.33	0.32
Hg	a	21	a	a	a	a	1.7
K	a	1	0.124	b	0.160	b	0.042
Mg	b	30	b	b	b	0.184	0.045
Mn	b	3	b	b	0.807	a	0.35
Mo	a	54	a	a	a	a	6.8
Na	a	?-1100	a	a	a	a	0.53
Ni	b	4	b	b	b	b	0.32
P	870	2	0.263	0.546	0.380	0.542	0.037
Pb	a	34	a	a	a	a	3.98
Pt	a	15	a	a	a	a	1.16
S	8450	6	0.993	0.762	0.867	1.20	0.066
Sb	a	2	b	a	a	a	0.088
Se	a	7	a	b	b	a	0.61
Si	a	28	0.540	0.706	b	0.898	0.11
Sn	a	4	b	b	a	a	0.22
Sr	a	22	a	a	a	a	2.5
Ti	a	1	b	b	0.269	a	0.053
V	a	3	a	a	a	a	0.24
Zn	910	4	1.70	b	b	b	0.34

[a]Concentration below the detection limit

[b]Element was detected but was below the level of quantitation (3 x detection limit)

[c]Detection limit is dependent on particulate loading, these values are based on a loading of 0.1 mg (which was the range of loading for samples submitted for X-ray).

TABLE 21. SUMMARY OF ELEMENTAL ANALYSIS OF CRANKCASE OIL AND TOTAL PARTICULATE FROM THE GMC METHANOL BUS

Individual Elements	Crankcase Oil, ppm	Detection Limit, ppm	Total Particulate, wt. %					Detection Limit, wt. %
			Cold Idle	Hot Idle	40 kph	CBD	Bus Cycle	
Al	a	70	0.068	0.046	0.042	0.019	0.044	0.004
As	a	7	a	a	a	a	a	0.065
Ba	b	2	a	a	a	a	b	0.019
Br	a	7	a	a	a	a	a	0.12
Ca	1570	1	0.394	0.662	0.240	0.252	0.417	0.004
Cd	b	1	0.014	b	0.007	b	b	0.002
Cl	210	16	0.047	0.039	0.028	a	0.040	0.005
Co	a	4	a	a	a	a	a	0.039
Cu	30	4	0.255	0.330	0.877	0.148	0.176	0.041
Cr	15	4	b	b	b	b	b	0.076
Fe	86	4	0.043	0.937	1.95	1.17	0.941	0.040
Hg	a	21	a	a	a	a	a	0.21
K	a	1	0.018	0.027	0.021	0.010	0.031	0.004
Mg	360	30	0.073	0.098	0.030	0.035	a	0.006
Mn	b	3	a	b	b	a	a	0.048
Mo	a	54	a	a	a	a	a	0.90
Na	a	1100	b	a	a	a	b	0.051
Ni	b	4	0.122	b	0.525	b	b	0.036
P	1280	2	0.296	0.470	0.159	0.226	0.256	0.008
Pb	a	34	a	a	a	a	a	0.50
Pt	a	15	a	a	a	a	a	0.15
S	4940	6	0.341	0.349	0.194	0.212	0.247	0.008
Sb	b	2	a	a	a	a	a	0.011
Se	a	7	a	a	a	a	b	0.074
Si	a	28	0.047	0.064	0.047	0.030	0.069	0.009
Sn	a	4	b	a	b	a	b	0.026
Sr	a	22	a	a	a	a	a	0.35
Ti	a	1	b	b	b	a	b	0.006
V	a	3	a	a	a	a	a	0.028
Zn	1240	4	0.308	0.616	0.199	0.210	0.274	0.043

[a]Concentration below the detection limit

[b]Element was detected but was below the level of quantitation (3 x detection limit)

[c]Detection limit is dependent on particulate loading, these values are based on a loading of 0.8 mg (which was the range of loading for samples submitted for X-ray).

Total particulate from the M.A.N. contained 3 to 4 percent Fe with lesser quantities of Ca, Cu, and S. Total particulate from the GMC generally contained 1 to 2 percent Fe with lesser quantities of Ca, P, and Zn. The greatest concentrations of these elements for the GMC were noted over the hot-idle condition, followed by lesser concentrations noted over bus cycle, CBD, and the 40 kph conditions. Concentrations of various elements in the particulate from the M.A.N. were mixed over the various conditions tested.

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APPENDIX A

REGULATED EMISSIONS TEST RESULTS FOR THE M.A.N. METHANOL BUS

Table	Description
1-3	Cold Idle
4-6	20 kph
7-9	40 kph
10-12	Hot Idle
13-15	CBD
16-18	Bus Cycle

TABLE A-1. C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-1 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45483. KM(28262. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.4 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.29 (3223.3)
TOT. 20X20 RATE SCMM (SCFM)	11.54 (407.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.54)
TOT FLOW STD. CU. METRES(SCF)	1543.0 (54483.)
HC SAMPLE METER/RANGE/PPM	48.9/22/ 48.90
HC BCKGRD METER/RANGE/PPM	8.8/ 2/ 8.80
CO SAMPLE METER/RANGE/PPM	16.6/13/ 14.81
CO BCKGRD METER/RANGE/PPM	.8/13/ .70
CO2 SAMPLE METER/RANGE/PCT	61.1/13/.1228
CO2 BCKGRD METER/RANGE/PCT	22.9/13/.0423
NOX SAMPLE METER/RANGE/PPM	4.5/12/ 4.50
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .26
DILUTION FACTOR	89.35
HC CONCENTRATION PPM	40.19
CO CONCENTRATION PPM	13.79
CO2 CONCENTRATION PCT	.0809
NOX CONCENTRATION PPM	4.15
HC MASS GRAMS	82.55
CO MASS GRAMS	24.771
CO2 MASS GRAMS	2285.40
NOX MASS GRAMS	12.641
MASS OF FUEL BURNED GRAMS	1774.65
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

		C-IDLE COMPOSITE RESULTS
CONT. HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT. NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 1.775 (3.913)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

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TABLE A-1 (CONT'D). C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-1 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45483. KM(28262. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.4 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.29 (3223.3)
TOT. 20X20 RATE SCMM (SCFM)	11.54 (407.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.54)
TOT FLOW STD. CU. METRES(SCF)	1543.0 (54483.)
HC SAMPLE METER/RANGE/PPM	52.0/ 2/ 52.00
HC BCKGRD METER/RANGE/PPM	10.0/ 2/10.00
CO SAMPLE METER/RANGE/PPM	16.6/13/ 14.81
CO BCKGRD METER/RANGE/PPM	.8/13/ .70
CO2 SAMPLE METER/RANGE/PCT	61.1/13/.1228
CO2 BCKGRD METER/RANGE/PCT	22.9/13/.0423
NOX SAMPLE METER/RANGE/PPM	19.4/ 1/ 5.84
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .26
DILUTION FACTOR	89.14
HC CONCENTRATION PPM	42.11
CO CONCENTRATION PPM	13.79
CO2 CONCENTRATION PCT	.0809
NOX CONCENTRATION PPM	5.58
HC MASS GRAMS	86.48
CO MASS GRAMS	24.771
CO2 MASS GRAMS	2285.43
NOX MASS GRAMS	17.005
MASS OF FUEL BURNED GRAMS	1778.61
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.779 (3.922)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-2. C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-1 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45511. KM(28279. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.05 (3215.0)
TOT. 20X20 RATE SCMM (SCFM)	11.60 (409.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.59)
TOT FLOW STD. CU. METRES(SCF)	1540.4 (54392.)
HC SAMPLE METER/RANGE/PPM	17.0/22/ 16.99
HC BCKGRD METER/RANGE/PPM	8.7/ 2/ 8.70
CO SAMPLE METER/RANGE/PPM	3.5/13/ 3.07
CO BCKGRD METER/RANGE/PPM	.4/13/ .35
CO2 SAMPLE METER/RANGE/PCT	66.4/13/.1346
CO2 BCKGRD METER/RANGE/PCT	25.9/13/.0484
NOX SAMPLE METER/RANGE/PPM	14.9/31/ 4.47
NOX BCKGRD METER/RANGE/PPM	1.4/ 1/ .44
DILUTION FACTOR	84.43
HC CONCENTRATION PPM	8.40
CO CONCENTRATION PPM	2.66
CO2 CONCENTRATION PCT	.0869
NOX CONCENTRATION PPM	3.95
HC MASS GRAMS	17.21
CO MASS GRAMS	4.769
CO2 MASS GRAMS	2449.47
NOX MASS GRAMS	11.916
MASS OF FUEL BURNED GRAMS	1805.88
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.806 (3.982)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-2 (CONT'D) C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-1 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45511. KM(28279. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.05 (3215.0)
TOT. 20X20 RATE SCMM (SCFM)	11.60 (409.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.59)
TOT FLOW STD. CU. METRES(SCF)	1540.4 (54392.)
HC SAMPLE METER/RANGE/PPM	19.3/ 2/ 19.30
HC BCKGRD METER/RANGE/PPM	11.4/ 2/11.40
CO SAMPLE METER/RANGE/PPM	3.5/13/ 3.07
CO BCKGRD METER/RANGE/PPM	.4/13/ .35
CO2 SAMPLE METER/RANGE/PCT	66.4/13/.1346
CO2 BCKGRD METER/RANGE/PCT	25.9/13/.0484
NOX SAMPLE METER/RANGE/PPM	16.9/ 1/ 5.09
NOX BCKGRD METER/RANGE/PPM	1.4/ 1/ .44
DILUTION FACTOR	84.29
HC CONCENTRATION PPM	8.04
CO CONCENTRATION PPM	2.66
CO2 CONCENTRATION PCT	.0869
NOX CONCENTRATION PPM	4.66
HC MASS GRAMS	16.47
CO MASS GRAMS	4.769
CO2 MASS GRAMS	2449.50
NOX MASS GRAMS	14.050
MASS OF FUEL BURNED GRAMS	1805.17
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.805 (3.980)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-3. C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-1 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45541. KM(28298. MILES)

BAROMETER 742.70 MM HG(29.24 IN HG)
RELATIVE HUMIDITY 70. PCT

DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 12.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.38 (3226.8)
TOT. 20X20 RATE SCMM (SCFM)	11.63 (410.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.58)
TOT FLOW STD. CU. METRES(SCF)	1545.8 (54583.)
HC SAMPLE METER/RANGE/PPM	26.5/22/ 26.46
HC BCKGRD METER/RANGE/PPM	10.0/ 2/10.00
CO SAMPLE METER/RANGE/PPM	8.1/12/ 7.87
CO BCKGRD METER/RANGE/PPM	.7/12/ .68
CO2 SAMPLE METER/RANGE/PCT	61.7/12/.1190
CO2 BCKGRD METER/RANGE/PCT	21.6/12/.0402
NOX SAMPLE METER/RANGE/PPM	12.9/31/ 3.88
NOX BCKGRD METER/RANGE/PPM	1.5/ 1/ .45
DILUTION FACTOR	94.26
HC CONCENTRATION PPM	16.57
CO CONCENTRATION PPM	7.00
CO2 CONCENTRATION PCT	.0792
NOX CONCENTRATION PPM	3.35
HC MASS GRAMS	34.09
CO MASS GRAMS	12.606
CO2 MASS GRAMS	2241.48
NOX MASS GRAMS	10.311
MASS OF FUEL BURNED GRAMS	1680.31
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.680 (3.705)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-3 (CONT'D). C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-1 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45541. KM(28298. MILES)

BAROMETER 742.70 MM HG(29.24 IN HG)
RELATIVE HUMIDITY 70. PCT

DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 12.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.38 (3226.8)
TOT. 20X20 RATE SCMM (SCFM)	11.63 (410.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.58)
TOT FLOW STD. CU. METRES(SCF)	1545.8 (54583.)
HC SAMPLE METER/RANGE/PPM	25.3/ 2/ 25.30
HC BCKGRD METER/RANGE/PPM	10.6/ 2/10.60
CO SAMPLE METER/RANGE/PPM	8.1/12/ 7.87
CO BCKGRD METER/RANGE/PPM	.7/12/ .68
CO2 SAMPLE METER/RANGE/PCT	61.7/12/.1190
CO2 BCKGRD METER/RANGE/PCT	21.6/12/.0402
NOX SAMPLE METER/RANGE/PPM	13.2/ 1/ 3.96
NOX BCKGRD METER/RANGE/PPM	1.5/ 1/ .45
DILUTION FACTOR	94.35
HC CONCENTRATION PPM	14.81
CO CONCENTRATION PPM	7.00
CO2 CONCENTRATION PCT	.0792
NOX CONCENTRATION PPM	3.51
HC MASS GRAMS	30.48
CO MASS GRAMS	12.606
CO2 MASS GRAMS	2241.47
NOX MASS GRAMS	10.820
MASS OF FUEL BURNED GRAMS	1676.68
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE	KM (MILES)	.00 (.00)
FUEL CONSUMPTION	KG (LB)	1.677 (3.697)
FUEL ECONOMY	L/100KM (MPG)	****** (.00)

TABLE A-4. 12.5MH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-2 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45486. KM(28264. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.4 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	12.5MH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.38 (3226.6)
TOT. 20X20 RATE SCMM (SCFM)	11.51 (406.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (.99)
TOT FLOW STD. CU. METRES(SCF)	1543.7 (54508.)
HC SAMPLE METER/RANGE/PPM	18.9/21/ 9.47
HC BCKGRD METER/RANGE/PPM	16.5/ 1/ 8.25
CO SAMPLE METER/RANGE/PPM	2.0/13/ 1.75
CO BCKGRD METER/RANGE/PPM	.5/13/ .44
CO2 SAMPLE METER/RANGE/PCT	98.8/13/.2194
CO2 BCKGRD METER/RANGE/PCT	26.7/13/.0500
NOX SAMPLE METER/RANGE/PPM	7.3/12/ 7.28
NOX BCKGRD METER/RANGE/PPM	2.5/ 1/ .77
DILUTION FACTOR	52.30
HC CONCENTRATION PPM	1.38
CO CONCENTRATION PPM	1.28
CO2 CONCENTRATION PCT	.1704
NOX CONCENTRATION PPM	6.37
HC MASS GRAMS	2.83
CO MASS GRAMS	2.308
CO2 MASS GRAMS	4816.58
NOX MASS GRAMS	19.415
MASS OF FUEL BURNED GRAMS	3511.95
MEASURED DISTANCE KM (MILES)	5.057 (3.143)
FUEL ECONOMY L/100KM (MPG)	87.09 (2.701)
HC GRAMS/KM (GRAMS/MILE)	.56 (.90)
CO GRAMS/KM (GRAMS/MILE)	.46 (.73)
CO2 GRAMS/KM (GRAMS/MILE)	952.5 (1532.6)
NOX GRAMS/KM (GRAMS/MILE)	3.84 (6.18)

12.5MH COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	.56 (.90)
	CO	GRAMS/KM (GRAMS/MILE)	.46 (.73)
	CO2	GRAMS/KM (GRAMS/MILE)	952.49 (1532.56)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	3.84 (6.18)

TOTAL DISTANCE KM (MILES)	5.06 (3.14)
FUEL CONSUMPTION KG (LB)	3.512 (7.744)
FUEL ECONOMY L/100KM (MPG)	87.09 (2.70)

TABLE A-4 (CONT'D). 12.5MH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-2 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45486. KM(28264. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.4 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	12.5MH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.38 (3226.6)
TOT. 20X20 RATE SCMM (SCFM)	11.51 (406.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (.99)
TOT FLOW STD. CU. METRES(SCF)	1543.7 (54508.)
HC SAMPLE METER/RANGE/PPM	21.0/ 2/ 21.00
HC BCKGRD METER/RANGE/PPM	19.2/ 2/19.20
CO SAMPLE METER/RANGE/PPM	2.0/13/ 1.75
CO BCKGRD METER/RANGE/PPM	.5/13/ .44
CO2 SAMPLE METER/RANGE/PCT	98.8/13/.2194
CO2 BCKGRD METER/RANGE/PCT	26.7/13/.0500
NOX SAMPLE METER/RANGE/PPM	26.7/ 1/ 8.03
NOX BCKGRD METER/RANGE/PPM	2.5/ 1/ .77
DILUTION FACTOR	52.03
HC CONCENTRATION PPM	2.17
CO CONCENTRATION PPM	1.28
CO2 CONCENTRATION PCT	.1704
NOX CONCENTRATION PPM	7.27
HC MASS GRAMS	4.46
CO MASS GRAMS	2.308
CO2 MASS GRAMS	4816.72
NOX MASS GRAMS	22.169
MASS OF FUEL BURNED GRAMS	3513.67
MEASURED DISTANCE KM (MILES)	5.057 (3.143)
FUEL ECONOMY L/100KM (MPG)	87.13 (2.700)
HC GRAMS/KM (GRAMS/MILE)	.88 (1.42)
CO GRAMS/KM (GRAMS/MILE)	.46 (.73)
CO2 GRAMS/KM (GRAMS/MILE)	952.5 (1532.6)
NOX GRAMS/KM (GRAMS/MILE)	4.38 (7.05)

12.5MH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	.88 (1.42)
CO	GRAMS/KM (GRAMS/MILE)	.46 (.73)
CO2	GRAMS/KM (GRAMS/MILE)	952.52 (1532.60)
NOX	GRAMS/KM (GRAMS/MILE)	4.38 (7.05)

TOTAL DISTANCE	KM (MILES)	5.06 (3.14)
FUEL CONSUMPTION	KG (LB)	3.514 (7.748)
FUEL ECONOMY	L/100KM (MPG)	87.13 (2.70)

TABLE A-5. 12.5MH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-2 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45515. KM(28282. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 60. PCT

DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
ABS. HUMIDITY 13.1 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	12.5MH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.34 (3225.0)
TOT. 20X20 RATE SCMM (SCFM)	11.48 (405.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (1.00)
TOT FLOW STD. CU. METRES(SCF)	1542.6 (54470.)
HC SAMPLE METER/RANGE/PPM	17.8/21/ 8.92
HC BCKGRD METER/RANGE/PPM	16.0/ 1/ 8.00
CO SAMPLE METER/RANGE/PPM	2.1/13/ 1.84
CO BCKGRD METER/RANGE/PPM	1.0/13/ .87
CO2 SAMPLE METER/RANGE/PCT	55.6/12/.2206
CO2 BCKGRD METER/RANGE/PCT	15.1/12/.0519
NOX SAMPLE METER/RANGE/PPM	21.3/31/ 6.38
NOX BCKGRD METER/RANGE/PPM	1.5/ 1/ .47
DILUTION FACTOR	52.05
HC CONCENTRATION PPM	1.07
CO CONCENTRATION PPM	.95
CO2 CONCENTRATION PCT	.1697
NOX CONCENTRATION PPM	5.78
HC MASS GRAMS	2.20
CO MASS GRAMS	1.705
CO2 MASS GRAMS	4792.80
NOX MASS GRAMS	17.828
MASS OF FUEL BURNED GRAMS	3493.32
MEASURED DISTANCE KM (MILES)	5.104 (3.172)
FUEL ECONOMY L/100KM (MPG)	85.82 (2.741)
HC GRAMS/KM (GRAMS/MILE)	.43 (.69)
CO GRAMS/KM (GRAMS/MILE)	.33 (.54)
CO2 GRAMS/KM (GRAMS/MILE)	939.0 (1510.8)
NOX GRAMS/KM (GRAMS/MILE)	3.49 (5.62)

12.5MH COMPOSITE RESULTS

CONT.	HC GRAMS/KM (GRAMS/MILE)	.43 (.69)
	CO GRAMS/KM (GRAMS/MILE)	.33 (.54)
	CO2 GRAMS/KM (GRAMS/MILE)	938.97 (1510.81)
CONT.	NOX GRAMS/KM (GRAMS/MILE)	3.49 (5.62)

TOTAL DISTANCE KM (MILES)	5.10 (3.17)
FUEL CONSUMPTION KG (LB)	3.493 (7.703)
FUEL ECONOMY L/100KM (MPG)	85.82 (2.74)

TABLE A-5 (CONT'D). 12.5MH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-2 RUN 2	VEHICLE NO. 1	TEST WEIGHT 12837. KG(28300. LBS)
VEHICLE MODEL 1983 M.A.N. METHANOL	DATE 6/26/85	ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
ENGINE 11.0 L(671. CID) I-6	BAG CART NO. 1	METHANOL EM-BUS-F
TRANSMISSION A-4	DYNO NO. 4	ODOMETER 45515. KM(28282. MILES)
GVW11100. KG(24470. LBS)	CVS NO. 11	
BAROMETER 740.66 MM HG(29.16 IN HG)	DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)	
RELATIVE HUMIDITY 60. PCT	ABS. HUMIDITY 13.1 GM/KG	NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	12.5MH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.34 (3225.0)
TOT. 20X20 RATE SCMM (SCFM)	11.48 (405.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (1.00)
TOT FLOW STD. CU. METRES(SCF)	1542.6 (54470.)
HC SAMPLE METER/RANGE/PPM	13.0/ 2/ 13.00
HC BCKGRD METER/RANGE/PPM	11.7/ 2/11.70
CO SAMPLE METER/RANGE/PPM	2.1/13/ 1.84
CO BCKGRD METER/RANGE/PPM	1.0/13/ .87
CO2 SAMPLE METER/RANGE/PCT	55.6/12/.2206
CO2 BCKGRD METER/RANGE/PCT	15.1/12/.0519
NOX SAMPLE METER/RANGE/PPM	27.1/ 1/ 8.15
NOX BCKGRD METER/RANGE/PPM	1.5/ 1/ .47
DILUTION FACTOR	51.95
HC CONCENTRATION PPM	1.53
CO CONCENTRATION PPM	.95
CO2 CONCENTRATION PCT	.1697
NOX CONCENTRATION PPM	7.69
HC MASS GRAMS	3.13
CO MASS GRAMS	1.705
CO2 MASS GRAMS	4792.85
NOX MASS GRAMS	23.707
MASS OF FUEL BURNED GRAMS	3494.28
MEASURED DISTANCE KM (MILES)	5.104 (3.172)
FUEL ECONOMY L/100KM (MPG)	85.84 (2.740)
HC GRAMS/KM (GRAMS/MILE)	.61 (.99)
CO GRAMS/KM (GRAMS/MILE)	.33 (.54)
CO2 GRAMS/KM (GRAMS/MILE)	939.0 (1510.8)
NOX GRAMS/KM (GRAMS/MILE)	4.64 (7.47)

12.5MH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	.61 (.99)
CO	GRAMS/KM (GRAMS/MILE)	.33 (.54)
CO2	GRAMS/KM (GRAMS/MILE)	938.98 (1510.82)
NOX	GRAMS/KM (GRAMS/MILE)	4.64 (7.47)

TOTAL DISTANCE KM (MILES)	5.10 (3.17)
FUEL CONSUMPTION KG (LB)	3.494 (7.705)
FUEL ECONOMY L/100KM (MPG)	85.84 (2.74)

TABLE A-6. 12.5MH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-2 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45546. KM(28301. MILES)

BAROMETER 743.46 MM HG(29.27 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	12.5MH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.0)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1543.4 (54499.)
HC SAMPLE METER/RANGE/PPM	20.0/21/ 9.99
HC BCKGRD METER/RANGE/PPM	17.8/ 1/ 8.90
CO SAMPLE METER/RANGE/PPM	1.5/12/ 1.46
CO BCKGRD METER/RANGE/PPM	1.1/12/ 1.07
CO2 SAMPLE METER/RANGE/PCT	95.2/12/.2059
CO2 BCKGRD METER/RANGE/PCT	24.4/12/.0449
NOX SAMPLE METER/RANGE/PPM	16.4/31/ 4.91
NOX BCKGRD METER/RANGE/PPM	2.4/ 1/ .72
DILUTION FACTOR	55.71
HC CONCENTRATION PPM	1.25
CO CONCENTRATION PPM	.39
CO2 CONCENTRATION PCT	.1618
NOX CONCENTRATION PPM	4.08
HC MASS GRAMS	2.57
CO MASS GRAMS	.704
CO2 MASS GRAMS	4572.81
NOX MASS GRAMS	12.689
MASS OF FUEL BURNED GRAMS	3332.38
MEASURED DISTANCE KM (MILES)	5.108 (3.175)
FUEL ECONOMY L/100KM (MPG)	81.80 (2.876)
HC GRAMS/KM (GRAMS/MILE)	.50 (.81)
CO GRAMS/KM (GRAMS/MILE)	.14 (.22)
CO2 GRAMS/KM (GRAMS/MILE)	895.1 (1440.3)
NOX GRAMS/KM (GRAMS/MILE)	2.48 (4.00)

12.5MH COMPOSITE RESULTS

CONT.	HC GRAMS/KM (GRAMS/MILE)	.50 (.81)
	CO GRAMS/KM (GRAMS/MILE)	.14 (.22)
	CO2 GRAMS/KM (GRAMS/MILE)	895.15 (1440.29)
CONT.	NOX GRAMS/KM (GRAMS/MILE)	2.48 (4.00)

TOTAL DISTANCE KM (MILES)	5.11 (3.17)
FUEL CONSUMPTION KG (LB)	3.332 (7.348)
FUEL ECONOMY L/100KM (MPG)	81.80 (2.88)

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TABLE A-6 (CONT'D). 12.5MH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-2 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45546. KM(28301. MILES)

BAROMETER 743.46 MM HG(29.27 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	12.5MH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.0)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1543.4 (54499.)
HC SAMPLE METER/RANGE/PPM	12.3/ 2/ 12.30
HC BCKGRD METER/RANGE/PPM	10.0/ 2/10.00
CO SAMPLE METER/RANGE/PPM	1.5/12/ 1.46
CO BCKGRD METER/RANGE/PPM	1.1/12/ 1.07
CO2 SAMPLE METER/RANGE/PCT	95.2/12/.2059
CO2 BCKGRD METER/RANGE/PCT	24.4/12/.0449
NOX SAMPLE METER/RANGE/PPM	24.8/ 1/ 7.44
NOX BCKGRD METER/RANGE/PPM	2.4/ 1/ .72
DILUTION FACTOR	55.65
HC CONCENTRATION PPM	2.48
CO CONCENTRATION PPM	.39
CO2 CONCENTRATION PCT	.1618
NOX CONCENTRATION PPM	6.73
HC MASS GRAMS	5.09
CO MASS GRAMS	.704
CO2 MASS GRAMS	4572.83
NOX MASS GRAMS	20.921
MASS OF FUEL BURNED GRAMS	3334.92
MEASURED DISTANCE KM (MILES)	5.108 (3.175)
FUEL ECONOMY L/100KM (MPG)	81.86 (2.874)
HC GRAMS/KM (GRAMS/MILE)	1.00 (1.60)
CO GRAMS/KM (GRAMS/MILE)	.14 (.22)
CO2 GRAMS/KM (GRAMS/MILE)	895.2 (1440.3)
NOX GRAMS/KM (GRAMS/MILE)	4.10 (6.59)

12.5MH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	1.00 (1.60)
CO	GRAMS/KM (GRAMS/MILE)	.14 (.22)
CO2	GRAMS/KM (GRAMS/MILE)	895.15 (1440.30)
NOX	GRAMS/KM (GRAMS/MILE)	4.10 (6.59)

TOTAL DISTANCE KM (MILES)	5.11 (3.17)
FUEL CONSUMPTION KG (LB)	3.335 (7.354)
FUEL ECONOMY L/100KM (MPG)	81.86 (2.87)

TABLE A-7. 25-MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-3 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) IP6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45491. KM(28267. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 65. PCT

DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
ABS. HUMIDITY 14.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.07

BAG RESULTS

TEST CYCLE	25-MPH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.47 (3229.9)
TOT. 20X20 RATE SCMM (SCFM)	11.44 (404.0)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.52)
TOT FLOW STD. CU. METRES(SCF)	1544.4 (54532.)
HC SAMPLE METER/RANGE/PPM	21.8/21/ 10.88
HC BCKGRD METER/RANGE/PPM	18.0/ 1/ 9.00
CO SAMPLE METER/RANGE/PPM	2.5/13/ 2.19
CO BCKGRD METER/RANGE/PPM	1.0/13/ .87
CO2 SAMPLE METER/RANGE/PCT	62.7/12/.2547
CO2 BCKGRD METER/RANGE/PCT	13.2/12/.0450
NOX SAMPLE METER/RANGE/PPM	9.6/12/ 9.63
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .26
DILUTION FACTOR	45.06
HC CONCENTRATION PPM	2.08
CO CONCENTRATION PPM	1.29
CO2 CONCENTRATION PCT	.2107
NOX CONCENTRATION PPM	9.14
HC MASS GRAMS	4.27
CO MASS GRAMS	2.319
CO2 MASS GRAMS	5957.06
NOX MASS GRAMS	28.826
MASS OF FUEL BURNED GRAMS	4343.67
MEASURED DISTANCE KM (MILES)	10.103 (6.279)
FUEL ECONOMY L/100KM (MPG)	53.91 (4.364)
HC GRAMS/KM (GRAMS/MILE)	.42 (.68)
CO GRAMS/KM (GRAMS/MILE)	.23 (.37)
CO2 GRAMS/KM (GRAMS/MILE)	589.6 (948.7)
NOX GRAMS/KM (GRAMS/MILE)	2.85 (4.59)

			25-MPH COMPOSITE RESULTS
CONT.	HC	GRAMS/KM (GRAMS/MILE)	.42 (.68)
	CO	GRAMS/KM (GRAMS/MILE)	.23 (.37)
CONT.	CO2	GRAMS/KM (GRAMS/MILE)	589.61 (948.69)
	NOX	GRAMS/KM (GRAMS/MILE)	2.85 (4.59)

TOTAL DISTANCE KM (MILES)	10.10 (6.28)
FUEL CONSUMPTION KG (LB)	4.344 (9.578)
FUEL ECONOMY L/100KM (MPG)	53.91 (4.36)

TABLE A-7 (CONT'D). 25-MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-3 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) IP6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45491. KM(28267. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 65. PCT

DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
ABS. HUMIDITY 14.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.07

BAG RESULTS

TEST CYCLE	25-MPH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.47 (3229.9)
TOT. 20X20 RATE SCMM (SCFM)	11.44 (404.0)
TOT. AUX. SAMPLE RATE SCMM (SCFM).	.04 (1.52)
TOT FLOW STD. CU. METRES(SCF)	1544.4 (54532.)
HC SAMPLE METER/RANGE/PPM	17.1/ 2/ 17.10
HC BCKGRD METER/RANGE/PPM	14.8/ 2/14.80
CO SAMPLE METER/RANGE/PPM	2.5/13/ 2.19
CO BCKGRD METER/RANGE/PPM	1.0/13/ .87
CO2 SAMPLE METER/RANGE/PCT	62.7/12/.2547
CO2 BCKGRD METER/RANGE/PCT	13.2/12/.0450
NOX SAMPLE METER/RANGE/PPM	36.0/ 1/10.82
NOX BCKGRD METER/RANGE/PPM	.8/ 1/ .26
DILUTION FACTOR	44.96
HC CONCENTRATION PPM	2.63
CO CONCENTRATION PPM	1.29
CO2 CONCENTRATION PCT	.2107
NOX CONCENTRATION PPM	10.57
HC MASS GRAMS	5.40
CO MASS GRAMS	2.319
CO2 MASS GRAMS	5957.13
NOX MASS GRAMS	33.311
MASS OF FUEL BURNED GRAMS	4344.85
MEASURED DISTANCE KM (MILES)	10.103 (6.279)
FUEL ECONOMY L/100KM (MPG)	53.92 (4.362)
HC GRAMS/KM (GRAMS/MILE)	.53 (.86)
CO GRAMS/KM (GRAMS/MILE)	.23 (.37)
CO2 GRAMS/KM (GRAMS/MILE)	589.6 (948.7)
NOX GRAMS/KM (GRAMS/MILE)	3.30 (5.30)

25-MPH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	.53 (.86)
CO	GRAMS/KM (GRAMS/MILE)	.23 (.37)
CO2	GRAMS/KM (GRAMS/MILE)	589.62 (948.70)
NOX	GRAMS/KM (GRAMS/MILE)	3.30 (5.30)

TOTAL DISTANCE KM (MILES)	10.10 (6.28)
FUEL CONSUMPTION KG (LB)	4.345 (9.580)
FUEL ECONOMY L/100KM (MPG)	53.92 (4.36)

TABLE A-8. 25-MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-3 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) IP6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45522. KM(28286. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 50. PCT

DRY BULB TEMP. 27.8 DEG C(82.0 DEG F)
ABS. HUMIDITY 12.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	25-MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	91.19 (3219.8)
TOT. 20X20 RATE SCMM (SCFM)	11.47 (405.0)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.54)
TOT FLOW STD. CU. METRES(SCF)	1540.7 (54401.)
HC SAMPLE METER/RANGE/PPM	20.0/21/ 10.00
HC BCKGRD METER/RANGE/PPM	17.1/ 1/ 8.55
CO SAMPLE METER/RANGE/PPM	1.9/13/ 1.66
CO BCKGRD METER/RANGE/PPM	.5/13/ .44
CO2 SAMPLE METER/RANGE/PCT	64.7/12/.2646
CO2 BCKGRD METER/RANGE/PCT	15.3/12/.0526
NOX SAMPLE METER/RANGE/PPM	29.2/31/ 8.76
NOX BCKGRD METER/RANGE/PPM	1.3/ 1/ .41
DILUTION FACTOR	43.41
HC CONCENTRATION PPM	1.65
CO CONCENTRATION PPM	1.20
CO2 CONCENTRATION PCT	.2132
NOX CONCENTRATION PPM	8.18
HC MASS GRAMS	3.38
CO MASS GRAMS	2.157
CO2 MASS GRAMS	6013.43
NOX MASS GRAMS	24.681
MASS OF FUEL BURNED GRAMS	4383.62
MEASURED DISTANCE KM (MILES)	10.147 (6.307)
FUEL ECONOMY L/100KM (MPG)	54.17 (4.343)
HC GRAMS/KM (GRAMS/MILE)	.33 (.54)
CO GRAMS/KM (GRAMS/MILE)	.21 (.34)
CO2 GRAMS/KM (GRAMS/MILE)	592.6 (953.5)
NOX GRAMS/KM (GRAMS/MILE)	2.43 (3.91)

25-MPH COMPOSITE RESULTS

CONT.	HC GRAMS/KM (GRAMS/MILE)	.33 (.54)
	CO GRAMS/KM (GRAMS/MILE)	.21 (.34)
	CO2 GRAMS/KM (GRAMS/MILE)	592.61 (953.51)
CONT.	NOX GRAMS/KM (GRAMS/MILE)	2.43 (3.91)

TOTAL DISTANCE KM (MILES)	10.15 (6.31)
FUEL CONSUMPTION KG (LB)	4.384 (9.666)
FUEL ECONOMY L/100KM (MPG)	54.17 (4.34)

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TABLE A-8 (CONT'D). 25-MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-3 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) IP6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45522. KM(28286. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 50. PCT

DRY BULB TEMP. 27.8 DEG C(82.0 DEG F)
ABS. HUMIDITY 12.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	25-MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	91.19 (3219.8)
TOT. 20X20 RATE SCMM (SCFM)	11.47 (405.0)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.54)
TOT FLOW STD. CU. METRES(SCF)	1540.7 (54401.)
HC SAMPLE METER/RANGE/PPM	13.3/ 2/ 13.30
HC BCKGRD METER/RANGE/PPM	12.0/ 2/12.00
CO SAMPLE METER/RANGE/PPM	1.9/13/ 1.66
CO BCKGRD METER/RANGE/PPM	.5/13/ .44
CO2 SAMPLE METER/RANGE/PCT	64.7/12/.2646
CO2 BCKGRD METER/RANGE/PCT	15.3/12/.0526
NOX SAMPLE METER/RANGE/PPM	38.2/ 1/11.48
NOX BCKGRD METER/RANGE/PPM	1.3/ 1/ .41
DILUTION FACTOR	43.36
HC CONCENTRATION PPM	1.58
CO CONCENTRATION PPM	1.20
CO2 CONCENTRATION PCT	.2132
NOX CONCENTRATION PPM	11.08
HC MASS GRAMS	3.23
CO MASS GRAMS	2.157
CO2 MASS GRAMS	6013.47
NOX MASS GRAMS	33.430
MASS OF FUEL BURNED GRAMS	4383.51
MEASURED DISTANCE KM (MILES)	10.147 (6.307)
FUEL ECONOMY L/100KM (MPG)	54.17 (4.343)
HC GRAMS/KM (GRAMS/MILE)	.32 (.51)
CO GRAMS/KM (GRAMS/MILE)	.21 (.34)
CO2 GRAMS/KM (GRAMS/MILE)	592.6 (953.5)
NOX GRAMS/KM (GRAMS/MILE)	3.29 (5.30)

25-MPH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	.32 (.51)
CO	GRAMS/KM (GRAMS/MILE)	.21 (.34)
CO2	GRAMS/KM (GRAMS/MILE)	592.61 (953.52)
NOX	GRAMS/KM (GRAMS/MILE)	3.29 (5.30)

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TOTAL DISTANCE KM (MILES)	10.15 (6.31)
FUEL CONSUMPTION KG (LB)	4.384 (9.666)
FUEL ECONOMY L/100KM (MPG)	54.17 (4.34)

TABLE A-9. 25-MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-3 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) IP6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45551. KM(28304. MILES)

BAROMETER 743.46 MM HG(29.27 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

	25-MPH
TEST CYCLE	
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	91.42 (3228.1)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.61)
TOT FLOW STD. CU. METRES(SCF)	1545.6 (54574.)
HC SAMPLE METER/RANGE/PPM	19.5/21/ 9.75
HC BCKGRD METER/RANGE/PPM	16.5/ 1/ 8.25
CO SAMPLE METER/RANGE/PPM	1.5/12/ 1.46
CO BCKGRD METER/RANGE/PPM	.4/12/ .39
CO2 SAMPLE METER/RANGE/PCT	60.0/13/.2566
CO2 BCKGRD METER/RANGE/PCT	12.7/13/.0485
NOX SAMPLE METER/RANGE/PPM	23.9/31/ 7.17
NOX BCKGRD METER/RANGE/PPM	3.3/ 1/ .99
DILUTION FACTOR	44.76
HC CONCENTRATION PPM	1.69
CO CONCENTRATION PPM	1.05
CO2 CONCENTRATION PCT	.2092
NOX CONCENTRATION PPM	6.03
HC MASS GRAMS	3.47
CO MASS GRAMS	1.887
CO2 MASS GRAMS	5918.29
NOX MASS GRAMS	18.755
MASS OF FUEL BURNED GRAMS	4314.14
MEASURED DISTANCE KM (MILES)	10.163 (6.316)
FUEL ECONOMY L/100KM (MPG)	53.23 (4.419)
HC GRAMS/KM (GRAMS/MILE)	.34 (.55)
CO GRAMS/KM (GRAMS/MILE)	.19 (.30)
CO2 GRAMS/KM (GRAMS/MILE)	582.4 (937.0)
NOX GRAMS/KM (GRAMS/MILE)	1.85 (2.97)

		25-MPH COMPOSITE RESULTS
CONT. HC	GRAMS/KM (GRAMS/MILE)	.34 (.55)
CO	GRAMS/KM (GRAMS/MILE)	.19 (.30)
CONT. CO2	GRAMS/KM (GRAMS/MILE)	582.36 (937.02)
NOX	GRAMS/KM (GRAMS/MILE)	1.85 (2.97)

TOTAL DISTANCE KM (MILES)	10.16 (6.32)
FUEL CONSUMPTION KG (LB)	4.314 (9.513)
FUEL ECONOMY L/100KM (MPG)	53.23 (4.42)

TABLE A-9 (CONT'D). 25-MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-3 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) IP6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45551. KM(28304. MILES)

BAROMETER 743.46 MM HG(29.27 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	25-MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	91.42 (3228.1)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.61)
TOT FLOW STD. CU. METRES(SCF)	1545.6 (54574.)
HC SAMPLE METER/RANGE/PPM	11.6/ 2/ 11.60
HC BCKGRD METER/RANGE/PPM	10.7/ 2/10.70
CO SAMPLE METER/RANGE/PPM	1.5/12/ 1.46
CO BCKGRD METER/RANGE/PPM	.4/12/ .39
CO2 SAMPLE METER/RANGE/PCT	60.0/13/.2566
CO2 BCKGRD METER/RANGE/PCT	12.7/13/.0485
NOX SAMPLE METER/RANGE/PPM	36.7/ 1/11.01
NOX BCKGRD METER/RANGE/PPM	3.3/ 1/ .99
DILUTION FACTOR	44.73
HC CONCENTRATION PPM	1.14
CO CONCENTRATION PPM	1.05
CO2 CONCENTRATION PCT	.2092
NOX CONCENTRATION PPM	10.04
HC MASS GRAMS	2.34
CO MASS GRAMS	1.887
CO2 MASS GRAMS	5918.31
NOX MASS GRAMS	31.246
MASS OF FUEL BURNED GRAMS	4313.03
MEASURED DISTANCE KM (MILES)	10.163 (6.316)
FUEL ECONOMY L/100KM (MPG)	53.22 (4.420)
HC GRAMS/KM (GRAMS/MILE)	.23 (.37)
CO GRAMS/KM (GRAMS/MILE)	.19 (.30)
CO2 GRAMS/KM (GRAMS/MILE)	582.4 (937.0)
NOX GRAMS/KM (GRAMS/MILE)	3.07 (4.95)

25-MPH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	.23 (.37)
CO	GRAMS/KM (GRAMS/MILE)	.19 (.30)
CO2	GRAMS/KM (GRAMS/MILE)	582.37 (937.03)
NOX	GRAMS/KM (GRAMS/MILE)	3.07 (4.95)

TOTAL DISTANCE KM (MILES)	10.16 (6.32)
FUEL CONSUMPTION KG (LB)	4.313 (9.510)
FUEL ECONOMY L/100KM (MPG)	53.22 (4.42)

TABLE A-10. H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-4 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45504. KM(28275. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 62. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.1 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.2
TOT. BLOWER RATE SCMM (SCFM)	91.48 (3230.2)
TOT. 20X20 RATE SCMM (SCFM)	11.54 (407.4)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (1.03)
TOT FLOW STD. CU. METRES(SCF)	1546.1 (54591.)
HC SAMPLE METER/RANGE/PPM	20.0/21/ 10.00
HC BCKGRD METER/RANGE/PPM	19.0/ 1/ 9.50
CO SAMPLE METER/RANGE/PPM	.8/13/ .70
CO BCKGRD METER/RANGE/PPM	.3/13/ .26
CO2 SAMPLE METER/RANGE/PCT	63.6/13/.1283
CO2 BCKGRD METER/RANGE/PCT	21.8/13/.0402
NOX SAMPLE METER/RANGE/PPM	6.3/12/ 6.30
NOX BCKGRD METER/RANGE/PPM	.3/ 1/ .11
DILUTION FACTOR	89.15
HC CONCENTRATION PPM	.60
CO CONCENTRATION PPM	.43
CO2 CONCENTRATION PCT	.0886
NOX CONCENTRATION PPM	6.06
HC MASS GRAMS	1.24
CO MASS GRAMS	.771
CO2 MASS GRAMS	2508.50
NOX MASS GRAMS	18.722
MASS OF FUEL BURNED GRAMS	1828.32
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	1807.45 (2908.19)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

		H-IDLE COMPOSITE RESULTS
CONT. HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT. NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.828 (4.031)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-10 (CONT'D). H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-4 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45504. KM(28275. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 62. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.1 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.2
TOT. BLOWER RATE SCMM (SCFM)	91.48 (3230.2)
TOT. 20X20 RATE SCMM (SCFM)	11.54 (407.4)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (1.03)
TOT FLOW STD. CU. METRES(SCF)	1546.1 (54591.)
HC SAMPLE METER/RANGE/PPM	14.4/ 2/ 14.40
HC BCKGRD METER/RANGE/PPM	12.7/ 2/12.70
CO SAMPLE METER/RANGE/PPM	.8/13/ .70
CO BCKGRD METER/RANGE/PPM	.3/13/ .26
CO2 SAMPLE METER/RANGE/PCT	63.6/13/.1283
CO2 BCKGRD METER/RANGE/PCT	21.8/13/.0402
NOX SAMPLE METER/RANGE/PPM	23.0/ 1/ 6.92
NOX BCKGRD METER/RANGE/PPM	.3/ 1/ .11
DILUTION FACTOR	88.85
HC CONCENTRATION PPM	1.84
CO CONCENTRATION PPM	.43
CO2 CONCENTRATION PCT	.0886
NOX CONCENTRATION PPM	6.81
HC MASS GRAMS	3.79
CO MASS GRAMS	.771
CO2 MASS GRAMS	2508.55
NOX MASS GRAMS	21.041
MASS OF FUEL BURNED GRAMS	1830.90
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	5511.24 (8867.59)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 1.831 (4.037)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

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TABLE A-11. H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-4 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45532. KM(28292. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 13.1 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.2
TOT. BLOWER RATE SCMM (SCFM)	91.11 (3217.0)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.7)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (1.03)
TOT FLOW STD. CU. METRES(SCF)	1539.3 (54353.)
HC SAMPLE METER/RANGE/PPM	17.1/21/ 8.54
HC BCKGRD METER/RANGE/PPM	16.5/ 1/ 8.25
CO SAMPLE METER/RANGE/PPM	.8/13/ .70
CO BCKGRD METER/RANGE/PPM	.4/13/ .35
CO2 SAMPLE METER/RANGE/PCT	68.3/13/.1390
CO2 BCKGRD METER/RANGE/PCT	27.0/13/.0506
NOX SAMPLE METER/RANGE/PPM	22.7/31/ 6.80
NOX BCKGRD METER/RANGE/PPM	2.5/ 1/ .77
DILUTION FACTOR	82.47
HC CONCENTRATION PPM	.39
CO CONCENTRATION PPM	.34
CO2 CONCENTRATION PCT	.0890
NOX CONCENTRATION PPM	5.89
HC MASS GRAMS	.80
CO MASS GRAMS	.617
CO2 MASS GRAMS	2508.12
NOX MASS GRAMS	18.131
MASS OF FUEL BURNED GRAMS	1827.42
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	1167.72 (1878.86)
CO GRAMS/KM (GRAMS/MILE)	896.71 (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	896.71 (******)
CONT.	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.827 (4.029)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

TABLE A-11 (CONT'D). H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-4 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45532. KM(28292. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 13.1 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.2
TOT. BLOWER RATE SCMM (SCFM)	91.11 (3217.0)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.7)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.03 (1.03)
TOT FLOW STD. CU. METRES(SCF)	1539.3 (54353.)
HC SAMPLE METER/RANGE/PPM	11.9/ 2/ 11.90
HC BCKGRD METER/RANGE/PPM	11.5/ 2/11.50
CO SAMPLE METER/RANGE/PPM	.8/13/ .70
CO BCKGRD METER/RANGE/PPM	.4/13/ .35
CO2 SAMPLE METER/RANGE/PCT	68.3/13/.1390
CO2 BCKGRD METER/RANGE/PCT	27.0/13/.0506
NOX SAMPLE METER/RANGE/PPM	27.8/ 1/ 8.36
NOX BCKGRD METER/RANGE/PPM	2.5/ 1/ .77
DILUTION FACTOR	82.27
HC CONCENTRATION PPM	.54
CO CONCENTRATION PPM	.34
CO2 CONCENTRATION PCT	.0890
NOX CONCENTRATION PPM	7.60
HC MASS GRAMS	1.11
CO MASS GRAMS	.617
CO2 MASS GRAMS	2508.16
NOX MASS GRAMS	23.375
MASS OF FUEL BURNED GRAMS	1827.75
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	1607.14 (2585.90)
CO GRAMS/KM (GRAMS/MILE)	896.73 (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

		H-IDLE COMPOSITE RESULTS
HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	896.73 (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.828 (4.030)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-12. H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-4 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45562. KM(28311. MILES)

BAROMETER 743.71 MM HG(29.28 IN HG)
RELATIVE HUMIDITY 60. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 12.6 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.36 (3225.7)
TOT. 20X20 RATE SCMM (SCFM)	11.55 (408.0)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.66)
TOT FLOW STD. CU. METRES(SCF)	1544.3 (54531.)
HC SAMPLE METER/RANGE/PPM	17.0/21/ 8.50
HC BCKGRD METER/RANGE/PPM	16.4/ 1/ 8.20
CO SAMPLE METER/RANGE/PPM	.8/12/ .78
CO BCKGRD METER/RANGE/PPM	.6/12/ .59
CO2 SAMPLE METER/RANGE/PCT	65.2/12/.1276
CO2 BCKGRD METER/RANGE/PCT	24.1/12/.0444
NOX SAMPLE METER/RANGE/PPM	19.2/31/ 5.76
NOX BCKGRD METER/RANGE/PPM	3.6/ 1/ 1.08
DILUTION FACTOR	89.77
HC CONCENTRATION PPM	.39
CO CONCENTRATION PPM	.19
CO2 CONCENTRATION PCT	.0837
NOX CONCENTRATION PPM	4.57
HC MASS GRAMS	.80
CO MASS GRAMS	.351
CO2 MASS GRAMS	2365.43
NOX MASS GRAMS	13.977
MASS OF FUEL BURNED GRAMS	1723.23
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	1157.21 (1861.95)
CO GRAMS/KM (GRAMS/MILE)	509.43 (819.68)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	509.43 (819.68)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.723 (3.800)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

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TABLE A-12 (CONT'D). H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-4 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45562. KM(28311. MILES)

BAROMETER 743.71 MM HG(29.28 IN HG)
RELATIVE HUMIDITY 60. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 12.6 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	91.36 (3225.7)
TOT. 20X20 RATE SCMM (SCFM)	11.55 (408.0)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.66)
TOT FLOW STD. CU. METRES(SCF)	1544.3 (54531.)
HC SAMPLE METER/RANGE/PPM	10.8/ 2/ 10.80
HC BCKGRD METER/RANGE/PPM	10.6/ 2/10.60
CO SAMPLE METER/RANGE/PPM	.8/12/ .78
CO BCKGRD METER/RANGE/PPM	.6/12/ .59
CO2 SAMPLE METER/RANGE/PCT	65.2/12/.1276
CO2 BCKGRD METER/RANGE/PCT	24.1/12/.0444
NOX SAMPLE METER/RANGE/PPM	27.9/ 1/ 8.37
NOX BCKGRD METER/RANGE/PPM	3.6/ 1/ 1.08
DILUTION FACTOR	89.61
HC CONCENTRATION PPM	.32
CO CONCENTRATION PPM	.19
CO2 CONCENTRATION PCT	.0837
NOX CONCENTRATION PPM	7.30
HC MASS GRAMS	.65
CO MASS GRAMS	.351
CO2 MASS GRAMS	2365.46
NOX MASS GRAMS	22.333
MASS OF FUEL BURNED GRAMS	1723.11
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	950.77 (1529.79)
CO GRAMS/KM (GRAMS/MILE)	509.46 (819.73)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	509.46 (819.73)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

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TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.723 (3.799)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

TABLE A-13. CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-5 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45504. KM(28275. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 66. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 14.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.08

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	590.5
TOT. BLOWER RATE SCMM (SCFM)	91.36 (3226.1)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.8)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	1012.4 (35749.)
HC SAMPLE METER/RANGE/PPM	19.5/21/ 9.73
HC BCKGRD METER/RANGE/PPM	17.6/ 1/ 8.80
CO SAMPLE METER/RANGE/PPM	1.6/13/ 1.40
CO BCKGRD METER/RANGE/PPM	.1/13/ .09
CO2 SAMPLE METER/RANGE/PCT	68.2/12/.2822
CO2 BCKGRD METER/RANGE/PCT	13.4/12/.0457
NOX SAMPLE METER/RANGE/PPM	15.6/12/15.63
NOX BCKGRD METER/RANGE/PPM	.4/ 1/ .14
DILUTION FACTOR	40.72
HC CONCENTRATION PPM	1.15
CO CONCENTRATION PPM	1.27
CO2 CONCENTRATION PCT	.2376
NOX CONCENTRATION PPM	15.09
HC MASS GRAMS	1.54
CO MASS GRAMS	1.502
CO2 MASS GRAMS	4404.06
NOX MASS GRAMS	31.636
MASS OF FUEL BURNED GRAMS	3209.42
MEASURED DISTANCE KM (MILES)	3.256 (2.024)
FUEL ECONOMY L/100KM (MPG)	123.60 (1.903)
HC GRAMS/KM (GRAMS/MILE)	.47 (.76)
CO GRAMS/KM (GRAMS/MILE)	.46 (.74)
CO2 GRAMS/KM (GRAMS/MILE)	1352.6 (2176.3)
NOX GRAMS/KM (GRAMS/MILE)	9.72 (15.63)

		CBD COMPOSITE RESULTS
CONT. HC	GRAMS/KM (GRAMS/MILE)	.47 (.76)
CO	GRAMS/KM (GRAMS/MILE)	.46 (.74)
CO2	GRAMS/KM (GRAMS/MILE)	1352.57 (2176.28)
CONT. NOX	GRAMS/KM (GRAMS/MILE)	9.72 (15.63)

TOTAL DISTANCE KM (MILES)	3.26 (2.02)
FUEL CONSUMPTION KG (LB)	3.209 (7.077)
FUEL ECONOMY L/100KM (MPG)	123.60 (1.90)

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TABLE A-13 (CONT'D) CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-5 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45504. KM(28275. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 66. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 14.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.08

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	590.5
TOT. BLOWER RATE SCMM (SCFM)	91.36 (3226.1)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.8)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	1012.4 (35749.)
HC SAMPLE METER/RANGE/PPM	30.3/ 2/ 30.30
HC BCKGRD METER/RANGE/PPM	27.2/ 2/27.20
CO SAMPLE METER/RANGE/PPM	1.6/13/ 1.40
CO BCKGRD METER/RANGE/PPM	.1/13/ .09
CO2 SAMPLE METER/RANGE/PCT	68.2/12/.2822
CO2 BCKGRD METER/RANGE/PCT	13.4/12/.0457
NOX SAMPLE METER/RANGE/PPM	53.4/ 1/16.04
NOX BCKGRD METER/RANGE/PPM	.4/ 1/ .14
DILUTION FACTOR	40.43
HC CONCENTRATION PPM	3.77
CO CONCENTRATION PPM	1.27
CO2 CONCENTRATION PCT	.2376
NOX CONCENTRATION PPM	15.90
HC MASS GRAMS	5.08
CO MASS GRAMS	1.502
CO2 MASS GRAMS	4404.21
NOX MASS GRAMS	33.342
MASS OF FUEL BURNED GRAMS	3213.07
MEASURED DISTANCE KM (MILES)	3.256 (2.024)
FUEL ECONOMY L/100KM (MPG)	123.74 (1.901)
HC GRAMS/KM (GRAMS/MILE)	1.56 (2.51)
CO GRAMS/KM (GRAMS/MILE)	.46 (.74)
CO2 GRAMS/KM (GRAMS/MILE)	1352.6 (2176.4)
NOX GRAMS/KM (GRAMS/MILE)	10.24 (16.48)

	CBD COMPOSITE RESULTS
HC GRAMS/KM (GRAMS/MILE)	1.56 (2.51)
CO GRAMS/KM (GRAMS/MILE)	.46 (.74)
CO2 GRAMS/KM (GRAMS/MILE)	1352.61 (2176.35)
NOX GRAMS/KM (GRAMS/MILE)	10.24 (16.48)

TOTAL DISTANCE KM (MILES)	3.26 (2.02)
FUEL CONSUMPTION KG (LB)	3.213 (7.085)
FUEL ECONOMY L/100KM (MPG)	123.74 (1.90)

TABLE A-14. CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-5 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45532. KM(28292. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
ABS. HUMIDITY 12.6 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	591.0
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.1)
TOT. 20X20 RATE SCMM (SCFM)	11.43 (403.6)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.55)
TOT FLOW STD. CU. METRES(SCF)	1012.1 (35738.)
HC SAMPLE METER/RANGE/PPM	17.2/21/ 8.58
HC BCKGRD METER/RANGE/PPM	16.1/ 1/ 8.05
CO SAMPLE METER/RANGE/PPM	1.8/13/ 1.57
CO BCKGRD METER/RANGE/PPM	.2/13/ .17
CO2 SAMPLE METER/RANGE/PCT	70.1/12/.2919
CO2 BCKGRD METER/RANGE/PCT	15.0/12/.0515
NOX SAMPLE METER/RANGE/PPM	15.1/12/15.08
NOX BCKGRD METER/RANGE/PPM	2.1/ 1/ .65
DILUTION FACTOR	39.38
HC CONCENTRATION PPM	.73
CO CONCENTRATION PPM	1.36
CO2 CONCENTRATION PCT	.2417
NOX CONCENTRATION PPM	14.11
HC MASS GRAMS	.98
CO MASS GRAMS	1.608
CO2 MASS GRAMS	4479.38
NOX MASS GRAMS	28.306
MASS OF FUEL BURNED GRAMS	3263.81
MEASURED DISTANCE KM (MILES)	3.262 (2.028)
FUEL ECONOMY L/100KM (MPG)	125.45 (1.875)
HC GRAMS/KM (GRAMS/MILE)	.30 (.49)
CO GRAMS/KM (GRAMS/MILE)	.49 (.79)
CO2 GRAMS/KM (GRAMS/MILE)	1373.1 (2209.3)
NOX GRAMS/KM (GRAMS/MILE)	8.68 (13.96)

			CBD	COMPOSITE RESULTS
CONT.	HC	GRAMS/KM (GRAMS/MILE)	.30 (	.49)
	CO	GRAMS/KM (GRAMS/MILE)	.49 (	.79)
	CO2	GRAMS/KM (GRAMS/MILE)	1373.09	(2209.30)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	8.68	(13.96)

TOTAL DISTANCE	KM (MILES)	3.26 (2.03)
FUEL CONSUMPTION	KG (LB)	3.264 (7.197)
FUEL ECONOMY	L/100KM (MPG)	125.45 (1.88)

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TABLE A-14 (CONT'D). CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-5 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45532. KM(28292. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
ABS. HUMIDITY 12.6 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	591.0
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.1)
TOT. 20X20 RATE SCMM (SCFM)	11.43 (403.6)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.55)
TOT FLOW STD. CU. METRES(SCF)	1012.1 (35738.)
HC SAMPLE METER/RANGE/PPM	12.3/ 2/ 12.30
HC BCKGRD METER/RANGE/PPM	11.4/ 2/11.40
CO SAMPLE METER/RANGE/PPM	1.8/13/ 1.57
CO BCKGRD METER/RANGE/PPM	.2/13/ .17
CO2 SAMPLE METER/RANGE/PCT	70.1/12/.2919
CO2 BCKGRD METER/RANGE/PCT	15.0/12/.0515
NOX SAMPLE METER/RANGE/PPM	60.0/ 1/18.02
NOX BCKGRD METER/RANGE/PPM	2.1/ 1/ .65
DILUTION FACTOR	39.33
HC CONCENTRATION PPM	1.19
CO CONCENTRATION PPM	1.36
CO2 CONCENTRATION PCT	.2417
NOX CONCENTRATION PPM	17.39
HC MASS GRAMS	1.60
CO MASS GRAMS	1.608
CO2 MASS GRAMS	4479.41
NOX MASS GRAMS	34.879
MASS OF FUEL BURNED GRAMS	3264.45
MEASURED DISTANCE KM (MILES)	3.262 (2.028)
FUEL ECONOMY L/100KM (MPG)	125.48 (1.875)
HC GRAMS/KM (GRAMS/MILE)	.49 (.79)
CO GRAMS/KM (GRAMS/MILE)	.49 (.79)
CO2 GRAMS/KM (GRAMS/MILE)	1373.1 (2209.3)
NOX GRAMS/KM (GRAMS/MILE)	10.69 (17.20)

	CBD COMPOSITE RESULTS
HC GRAMS/KM (GRAMS/MILE)	.49 (.79)
CO GRAMS/KM (GRAMS/MILE)	.49 (.79)
CO2 GRAMS/KM (GRAMS/MILE)	1373.10 (2209.31)
NOX GRAMS/KM (GRAMS/MILE)	10.69 (17.20)
TOTAL DISTANCE KM (MILES)	3.26 (2.03)
FUEL CONSUMPTION KG (LB)	3.264 (7.198)
FUEL ECONOMY L/100KM (MPG)	125.48 (1.87)

TABLE A-15. CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-5 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45565. KM(28313. MILES)

BAROMETER 743.71 MM HG(29.28 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 13.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	589.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.1)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.65)
TOT FLOW STD. CU. METRES(SCF)	1010.2 (35670.)
HC SAMPLE METER/RANGE/PPM	18.6/21/ 9.30
HC BCKGRD METER/RANGE/PPM	16.6/ 1/ 8.30
CO SAMPLE METER/RANGE/PPM	1.7/12/ 1.66
CO BCKGRD METER/RANGE/PPM	.3/12/ .29
CO2 SAMPLE METER/RANGE/PCT	65.4/13/.2830
CO2 BCKGRD METER/RANGE/PCT	12.0/13/.0458
NOX SAMPLE METER/RANGE/PPM	14.2/12/14.20
NOX BCKGRD METER/RANGE/PPM	3.8/ 1/ 1.14
DILUTION FACTOR	40.61
HC CONCENTRATION PPM	1.21
CO CONCENTRATION PPM	1.33
CO2 CONCENTRATION PCT	.2383
NOX CONCENTRATION PPM	12.75
HC MASS GRAMS	1.62
CO MASS GRAMS	1.568
CO2 MASS GRAMS	4407.76
NOX MASS GRAMS	25.831
MASS OF FUEL BURNED GRAMS	3212.27
MEASURED DISTANCE KM (MILES)	3.269 (2.032)
FUEL ECONOMY L/100KM (MPG)	123.21 (1.909)
HC GRAMS/KM (GRAMS/MILE)	.50 (.80)
CO GRAMS/KM (GRAMS/MILE)	.48 (.77)
CO2 GRAMS/KM (GRAMS/MILE)	1348.3 (2169.4)
NOX GRAMS/KM (GRAMS/MILE)	7.90 (12.71)

		CBD COMPOSITE RESULTS
CONT.	HC GRAMS/KM (GRAMS/MILE)	.50 (.80)
	CO GRAMS/KM (GRAMS/MILE)	.48 (.77)
CONT.	CO2 GRAMS/KM (GRAMS/MILE)	1348.29 (2169.40)
	NOX GRAMS/KM (GRAMS/MILE)	7.90 (12.71)

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TOTAL DISTANCE KM (MILES)	3.27 (2.03)
FUEL CONSUMPTION KG (LB)	3.212 (7.083)
FUEL ECONOMY L/100KM (MPG)	123.21 (1.91)

TABLE A-15 (CONT'D). CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-5 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45565. KM(28313. MILES)

BAROMETER 743.71 MM HG(29.28 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 13.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	589.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.1)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.65)
TOT FLOW STD. CU. METRES(SCF)	1010.2 (35670.)
HC SAMPLE METER/RANGE/PPM	11.4/ 2/ 11.40
HC BCKGRD METER/RANGE/PPM	10.4/ 2/10.40
CO SAMPLE METER/RANGE/PPM	1.7/12/ 1.66
CO BCKGRD METER/RANGE/PPM	.3/12/ .29
CO2 SAMPLE METER/RANGE/PCT	65.4/13/.2830
CO2 BCKGRD METER/RANGE/PCT	12.0/13/.0458
NOX SAMPLE METER/RANGE/PPM	56.3/ 1/16.89
NOX BCKGRD METER/RANGE/PPM	3.8/ 1/ 1.14
DILUTION FACTOR	40.58
HC CONCENTRATION PPM	1.26
CO CONCENTRATION PPM	1.33
CO2 CONCENTRATION PCT	.2383
NOX CONCENTRATION PPM	15.78
HC MASS GRAMS	1.69
CO MASS GRAMS	1.568
CO2 MASS GRAMS	4407.78
NOX MASS GRAMS	31.954
MASS OF FUEL BURNED GRAMS	3212.35
MEASURED DISTANCE KM (MILES)	3.269 (2.032)
FUEL ECONOMY L/100KM (MPG)	123.22 (1.909)
HC GRAMS/KM (GRAMS/MILE)	.52 (.83)
CO GRAMS/KM (GRAMS/MILE)	.48 (.77)
CO2 GRAMS/KM (GRAMS/MILE)	1348.3 (2169.4)
NOX GRAMS/KM (GRAMS/MILE)	9.77 (15.73)

	CBD COMPOSITE RESULTS
HC GRAMS/KM (GRAMS/MILE)	.52 (.83)
CO GRAMS/KM (GRAMS/MILE)	.48 (.77)
CO2 GRAMS/KM (GRAMS/MILE)	1348.29 (2169.41)
NOX GRAMS/KM (GRAMS/MILE)	9.77 (15.73)

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TOTAL DISTANCE KM (MILES)	3.27 (2.03)
FUEL CONSUMPTION KG (LB)	3.212 (7.083)
FUEL ECONOMY L/100KM (MPG)	123.22 (1.91)

(TABLE A-16. BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-6 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45507. KM(28277. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 66. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 14.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.08

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1198.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.2)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.8)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	2052.6 (72477.)
HC SAMPLE METER/RANGE/PPM	22.6/21/ 11.28
HC BCKGRD METER/RANGE/PPM	20.2/ 1/10.10
CO SAMPLE METER/RANGE/PPM	1.4/13/ 1.22
CO BCKGRD METER/RANGE/PPM	.5/13/ .44
CO2 SAMPLE METER/RANGE/PCT	88.1/13/.1879
CO2 BCKGRD METER/RANGE/PCT	23.6/13/.0437
NOX SAMPLE METER/RANGE/PPM	9.2/12/ 9.22
NOX BCKGRD METER/RANGE/PPM	.7/ 1/ .23
DILUTION FACTOR	61.00
HC CONCENTRATION PPM	1.35
CO CONCENTRATION PPM	.77
CO2 CONCENTRATION PCT	.1448
NOX CONCENTRATION PPM	8.76
HC MASS GRAMS	3.68
CO MASS GRAMS	1.842
CO2 MASS GRAMS	5442.89
NOX MASS GRAMS	37.253
MASS OF FUEL BURNED GRAMS	3968.21
MEASURED DISTANCE KM (MILES)	4.677 (2.907)
FUEL ECONOMY L/100KM (MPG)	106.39 (2.211)
HC GRAMS/KM (GRAMS/MILE)	.79 (1.26)
CO GRAMS/KM (GRAMS/MILE)	.39 (.63)
CO2 GRAMS/KM (GRAMS/MILE)	1163.8 (1872.5)
NOX GRAMS/KM (GRAMS/MILE)	7.97 (12.82)

		BUS COMPOSITE RESULTS
CONT. HC	GRAMS/KM (GRAMS/MILE)	.79 (1.26)
CO	GRAMS/KM (GRAMS/MILE)	.39 (.63)
CO2	GRAMS/KM (GRAMS/MILE)	1163.76 (1872.49)
CONT. NOX	GRAMS/KM (GRAMS/MILE)	7.97 (12.82)

TOTAL DISTANCE KM (MILES)	4.68 (2.91)
FUEL CONSUMPTION KG (LB)	3.968 (8.750)
FUEL ECONOMY L/100KM (MPG)	106.39 (2.21)

TABLE A-16 (CONT'D). BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-6 RUN 1
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/25/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45507. KM(28277. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 66. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 14.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.08

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1198.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.2)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.8)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	2052.6 (72477.)
HC SAMPLE METER/RANGE/PPM	20.9/ 2/ 20.90
HC BCKGRD METER/RANGE/PPM	19.0/ 2/19.00
CO SAMPLE METER/RANGE/PPM	1.4/13/ 1.22
CO BCKGRD METER/RANGE/PPM	.5/13/ .44
CO2 SAMPLE METER/RANGE/PCT	88.1/13/.1879
CO2 BCKGRD METER/RANGE/PCT	23.6/13/.0437
NOX SAMPLE METER/RANGE/PPM	34.4/ 1/10.34
NOX BCKGRD METER/RANGE/PPM	.7/ 1/ .23
DILUTION FACTOR	60.69
HC CONCENTRATION PPM	2.21
CO CONCENTRATION PPM	.77
CO2 CONCENTRATION PCT	.1448
NOX CONCENTRATION PPM	10.11
HC MASS GRAMS	6.05
CO MASS GRAMS	1.842
CO2 MASS GRAMS	5443.03
NOX MASS GRAMS	42.994
MASS OF FUEL BURNED GRAMS	3970.68
MEASURED DISTANCE KM (MILES)	4.677 (2.907)
FUEL ECONOMY L/100KM (MPG)	106.46 (2.210)
HC GRAMS/KM (GRAMS/MILE)	1.29 (2.08)
CO GRAMS/KM (GRAMS/MILE)	.39 (.63)
CO2 GRAMS/KM (GRAMS/MILE)	1163.8 (1872.5)
NOX GRAMS/KM (GRAMS/MILE)	9.19 (14.79)

	BUS COMPOSITE RESULTS
HC GRAMS/KM (GRAMS/MILE)	1.29 (2.08)
CO GRAMS/KM (GRAMS/MILE)	.39 (.63)
CO2 GRAMS/KM (GRAMS/MILE)	1163.79 (1872.53)
NOX GRAMS/KM (GRAMS/MILE)	9.19 (14.79)
TOTAL DISTANCE KM (MILES)	4.68 (2.91)
FUEL CONSUMPTION KG (LB)	3.971 (8.755)
FUEL ECONOMY L/100KM (MPG)	106.46 (2.21)

TABLE A-17. BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-6 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45535. KM(28294. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1196.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.2)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.56)
TOT FLOW STD. CU. METRES(SCF)	2049.0 (72349.)
HC SAMPLE METER/RANGE/PPM	17.0/21/ 8.50
HC BCKGRD METER/RANGE/PPM	15.7/ 1/ 7.85
CO SAMPLE METER/RANGE/PPM	1.3/13/ 1.14
CO BCKGRD METER/RANGE/PPM	.7/13/ .61
CO2 SAMPLE METER/RANGE/PCT	91.0/13/.1959
CO2 BCKGRD METER/RANGE/PCT	26.2/13/.0490
NOX SAMPLE METER/RANGE/PPM	10.1/12/10.08
NOX BCKGRD METER/RANGE/PPM	1.8/ 1/ .56
DILUTION FACTOR	58.59
HC CONCENTRATION PPM	.78
CO CONCENTRATION PPM	.52
CO2 CONCENTRATION PCT	.1478
NOX CONCENTRATION PPM	9.30
HC MASS GRAMS	2.14
CO MASS GRAMS	1.237
CO2 MASS GRAMS	5544.30
NOX MASS GRAMS	38.389
MASS OF FUEL BURNED GRAMS	4039.80
MEASURED DISTANCE KM (MILES)	4.747 (2.950)
FUEL ECONOMY L/100KM (MPG)	106.71 (2.204)
HC GRAMS/KM (GRAMS/MILE)	.45 (.72)
CO GRAMS/KM (GRAMS/MILE)	.26 (.42)
CO2 GRAMS/KM (GRAMS/MILE)	1167.9 (1879.2)
NOX GRAMS/KM (GRAMS/MILE)	8.09 (13.01)

		BUS COMPOSITE RESULTS
CONT.	HC GRAMS/KM (GRAMS/MILE)	.45 (.72)
	CO GRAMS/KM (GRAMS/MILE)	.26 (.42)
	CO2 GRAMS/KM (GRAMS/MILE)	1167.91 (1879.17)
CONT.	NOX GRAMS/KM (GRAMS/MILE)	8.09 (13.01)

TOTAL DISTANCE KM (MILES)	4.75 (2.95)
FUEL CONSUMPTION KG (LB)	4.040 (8.908)
FUEL ECONOMY L/100KM (MPG)	106.71 (2.20)

TABLE A-17 (CONT'D). BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-6 RUN 2
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/26/85
BAG CART NO. 1
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45535. KM(28294. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1196.1
TOT. BLOWER RATE SCMM (SCFM)	91.28 (3223.2)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.56)
TOT FLOW STD. CU. METRES(SCF)	2049.0 (72349.)
HC SAMPLE METER/RANGE/PPM	11.6/ 2/ 11.60
HC BCKGRD METER/RANGE/PPM	10.9/ 2/10.90
CO SAMPLE METER/RANGE/PPM	1.3/13/ 1.14
CO BCKGRD METER/RANGE/PPM	.7/13/ .61
CO2 SAMPLE METER/RANGE/PCT	91.0/13/.1959
CO2 BCKGRD METER/RANGE/PCT	26.2/13/.0490
NOX SAMPLE METER/RANGE/PPM	37.4/ 1/11.24
NOX BCKGRD METER/RANGE/PPM	1.8/ 1/ .56
DILUTION FACTOR	58.50
HC CONCENTRATION PPM	.89
CO CONCENTRATION PPM	.52
CO2 CONCENTRATION PCT	.1478
NOX CONCENTRATION PPM	10.69
HC MASS GRAMS	2.42
CO MASS GRAMS	1.237
CO2 MASS GRAMS	5544.35
NOX MASS GRAMS	44.140
MASS OF FUEL BURNED GRAMS	4040.12
MEASURED DISTANCE KM (MILES)	4.747 (2.950)
FUEL ECONOMY L/100KM (MPG)	106.72 (2.204)
HC GRAMS/KM (GRAMS/MILE)	.51 (.82)
CO GRAMS/KM (GRAMS/MILE)	.26 (.42)
CO2 GRAMS/KM (GRAMS/MILE)	1167.9 (1879.2)
NOX GRAMS/KM (GRAMS/MILE)	9.30 (14.96)

	BUS COMPOSITE RESULTS
HC GRAMS/KM (GRAMS/MILE)	.51 (.82)
CO GRAMS/KM (GRAMS/MILE)	.26 (.42)
CO2 GRAMS/KM (GRAMS/MILE)	1167.92 (1879.19)
NOX GRAMS/KM (GRAMS/MILE)	9.30 (14.96)

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TOTAL DISTANCE KM (MILES)	4.75 (2.95)
FUEL CONSUMPTION KG (LB)	4.040 (8.908)
FUEL ECONOMY L/100KM (MPG)	106.72 (2.20)

TABLE A-18. BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-6 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45565. KM(28313. MILES)

BAROMETER 743.97 MM HG(29.29 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 13.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1198.2
TOT. BLOWER RATE SCMM (SCFM)	91.32 (3224.6)
TOT. 20X20 RATE SCMM (SCFM)	11.57 (408.4)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.64)
TOT FLOW STD. CU. METRES(SCF)	2055.6 (72584.)
HC SAMPLE METER/RANGE/PPM	17.5/21/ 8.75
HC BCKGRD METER/RANGE/PPM	15.7/ 1/ 7.85
CO SAMPLE METER/RANGE/PPM	.6/12/ .59
CO BCKGRD METER/RANGE/PPM	.1/12/ .10
CO2 SAMPLE METER/RANGE/PCT	87.9/12/.1877
CO2 BCKGRD METER/RANGE/PCT	23.6/12/.0436
NOX SAMPLE METER/RANGE/PPM	8.7/12/ 8.65
NOX BCKGRD METER/RANGE/PPM	4.1/ 1/ 1.23
DILUTION FACTOR	61.16
HC CONCENTRATION PPM	1.03
CO CONCENTRATION PPM	.48
CO2 CONCENTRATION PCT	.1448
NOX CONCENTRATION PPM	7.25
HC MASS GRAMS	2.81
CO MASS GRAMS	1.143
CO2 MASS GRAMS	5450.77
NOX MASS GRAMS	29.860
MASS OF FUEL BURNED GRAMS	3972.28
MEASURED DISTANCE KM (MILES)	4.707 (2.925)
FUEL ECONOMY L/100KM (MPG)	105.83 (2.223)
HC GRAMS/KM (GRAMS/MILE)	.60 (.96)
CO GRAMS/KM (GRAMS/MILE)	.24 (.39)
CO2 GRAMS/KM (GRAMS/MILE)	1158.1 (1863.4)
NOX GRAMS/KM (GRAMS/MILE)	6.34 (10.21)

		BUS COMPOSITE RESULTS	
CONT.	HC GRAMS/KM (GRAMS/MILE)	.60 (.96)	
	CO GRAMS/KM (GRAMS/MILE)	.24 (.39)	
	CO2 GRAMS/KM (GRAMS/MILE)	1158.11	(1863.41)
CONT.	NOX GRAMS/KM (GRAMS/MILE)	6.34	(10.21)

TOTAL DISTANCE KM (MILES)	4.71	(2.93)
FUEL CONSUMPTION KG (LB)	3.972	(8.759)
FUEL ECONOMY L/100KM (MPG)	105.83	(2.22)

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VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1-6 RUN 3
VEHICLE MODEL 1983 M.A.N. METHANOL
ENGINE 11.0 L(671. CID) I-6
TRANSMISSION A-4
GVW11100. KG(24470. LBS)

VEHICLE NO. 1
DATE 6/27/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 12837. KG(28300. LBS)
ACTUAL ROAD LOAD 57.6 KW(77.3 HP)
METHANOL EM-BUS-F
ODOMETER 45565. KM(28313. MILES)

BAROMETER 743.97 MM HG(29.29 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 26.7 DEG C(80.0 DEG F)
ABS. HUMIDITY 13.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE		BUS
RUN TIME	SECONDS	1198.2
TOT. BLOWER RATE SCMM (SCFM)		91.32 (3224.6)
TOT. 20X20 RATE SCMM (SCFM)		11.57 (408.4)
TOT. AUX. SAMPLE RATE SCMM (SCFM)		.05 (1.64)
TOT FL	IETRES(SCF)	2055.6 (72584.)
HC SA	NGE/PPM	10.7/ 2/ 10.70
HC BC	NGE/PPM	10.3/ 2/10.30
CO SA	NGE/PPM	.6/12/ .59
CO BC	NGE/PPM	.1/12/ .10
CO2 SA	NGE/PCT	87.9/12/.1877
CO2 BC	NGE/PCT	23.6/12/.0436
NOX SA	NGE/PPM	35.4/ 1/10.62
NOX BC	NGE/PPM	4.1/ 1/ 1.23
DILUTI		61.10
HC CC	PM	.57
CO CC	PM	.48
CO2 CC	CT	.1448
NOX CC	PM	9.41
HC MA		1.56
CO MA		1.143
CO2 MA		5450.79
NOX MA		38.776
MASS (	) GRAMS	3971.04
MEASUF	KM (MILES)	4.707 (2.925)
FUEL E	KM (MPG)	105.80 (2.223)
HC (	S/MILE)	.33 (.53)
CO (	S/MILE)	.24 (.39)
CO2 (	S/MILE)	1158.1 (1863.4)
NOX (	S/MILE)	8.24 (13.26)

		BUS	COMPOSITE RESULTS
HC	GRAMS/KM (GRAMS/MILE)	.33 (.53)	
CO	GRAMS/KM (GRAMS/MILE)	.24 (.39)	
CO2	GRAMS/KM (GRAMS/MILE)	1158.12 (1863.42)	
NOX	GRAMS/KM (GRAMS/MILE)	8.24 (13.26)	

TOTAL DISTANCE	KM (MILES)	4.71 (2.93)
FUEL CONSUMPTION	KG (LB)	3.971 (8.756)
FUEL ECONOMY	L/100KM (MPG)	105.80 (2.22)

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APPENDIX B

REGULATED EMISSIONS TEST RESULTS FOR THE GMC METHANOL BUS

Table	Description
1-3	Cold Idle
4-6	20 kph
7-9	40 kph
10-12	Hot Idle
13-15	CBD
16-18	Bus Cycle

TABLE B-1. C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.4 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.7
TOT. BLOWER RATE SCMM (SCFM)	89.83 (3172.0)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1522.8 (53770.)
HC SAMPLE METER/RANGE/PPM	30.4/24/304.25
HC BCKGRD METER/RANGE/PPM	2.7/ 4/27.00
CO SAMPLE METER/RANGE/PPM	71.2/12/ 70.69
CO BCKGRD METER/RANGE/PPM	3.7/12/ 3.61
CO2 SAMPLE METER/RANGE/PCT	81.4/12/.1703
CO2 BCKGRD METER/RANGE/PCT	23.6/12/.0436
NOX SAMPLE METER/RANGE/PPM	7.1/31/ 2.14
NOX BCKGRD METER/RANGE/PPM	1.3/ 1/ .39
DILUTION FACTOR	55.56
HC CONCENTRATION PPM	277.73
CO CONCENTRATION PPM	65.40
CO2 CONCENTRATION PCT	.1275
NOX CONCENTRATION PPM	1.71
HC MASS GRAMS	562.90
CO MASS GRAMS	115.947
CO2 MASS GRAMS	3555.51
NOX MASS GRAMS	5.246
MASS OF FUEL BURNED GRAMS	3283.95
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.000)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE

GRAMS/TEST	2.002
GRAMS/KG FUEL	.61
GRAMS/KM	******
GRAMS/MILE	******

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	3.284 (7.241)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

FILTER EFF. 71.57

TABLE B-1 (CONT'D). C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.4 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.7
TOT. BLOWER RATE SCMM (SCFM)	89.83 (3172.0)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1522.8 (53770.)
HC SAMPLE METER/RANGE/PPM	19.1/ 3/191.00
HC BCKGRD METER/RANGE/PPM	3.6/ 3/36.00
CO SAMPLE METER/RANGE/PPM	71.2/12/ 70.69
CO BCKGRD METER/RANGE/PPM	3.7/12/ 3.61
CO2 SAMPLE METER/RANGE/PCT	81.4/12/.1703
CO2 BCKGRD METER/RANGE/PCT	23.6/12/.0436
NOX SAMPLE METER/RANGE/PPM	7.2/ 1/ 2.16
NOX BCKGRD METER/RANGE/PPM	1.3/ 1/ .39
DILUTION FACTOR	58.77
HC CONCENTRATION PPM	155.61
CO CONCENTRATION PPM	65.40
CO2 CONCENTRATION PCT	.1275
NOX CONCENTRATION PPM	1.78
HC MASS GRAMS	315.39
CO MASS GRAMS	115.941
CO2 MASS GRAMS	3554.32
NOX MASS GRAMS	5.445
MASS OF FUEL BURNED GRAMS	3035.57
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.000)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

HC GRAMS/KM (GRAMS/MILE)	***** (*****)	PARTICULATE RATE
CO GRAMS/KM (GRAMS/MILE)	****** (******)	GRAMS/TEST 2.002
CO2 GRAMS/KM (GRAMS/MILE)	******* (*******)	GRAMS/KG FUEL .66
NOX GRAMS/KM (GRAMS/MILE)	***** (*****)	GRAMS/KM ******
		GRAMS/MILE ******
TOTAL DISTANCE KM (MILES)	.00 (.00)	
FUEL CONSUMPTION KG (LB)	3.036 (6.693)	FILTER EFF. 71.57
FUEL ECONOMY L/100KM (MPG)	****** (.00)	

TABLE B-2. C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 57. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 11.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	90.56 (3197.5)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.66)
TOT FLOW STD. CU. METRES(SCF)	1532.4 (54109.)
HC SAMPLE METER/RANGE/PPM	30.8/24/308.16
HC BCKGRD METER/RANGE/PPM	1.9/ 4/19.00
CO SAMPLE METER/RANGE/PPM	62.8/12/ 61.97
CO BCKGRD METER/RANGE/PPM	2.4/12/ 2.34
CO2 SAMPLE METER/RANGE/PCT	77.1/12/.1587
CO2 BCKGRD METER/RANGE/PCT	22.8/12/.0422
NOX SAMPLE METER/RANGE/PPM	6.0/31/ 1.81
NOX BCKGRD METER/RANGE/PPM	1.2/ 1/ .36
DILUTION FACTOR	58.99
HC CONCENTRATION PPM	289.48
CO CONCENTRATION PPM	58.28
CO2 CONCENTRATION PCT	.1172
NOX CONCENTRATION PPM	1.42
HC MASS GRAMS	590.42
CO MASS GRAMS	103.976
CO2 MASS GRAMS	3287.61
NOX MASS GRAMS	4.251
MASS OF FUEL BURNED GRAMS	3102.75
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.000)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE

GRAMS/TEST	1.472
GRAMS/KG FUEL	.47
GRAMS/KM	******
GRAMS/MILE	******

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	3.103 (6.842)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

FILTER EFF. 76.31

TABLE B-2 (CONT'D). C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 57. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 11.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	90.56 (3197.5)
TOT. 20X20 RATE SCMM (SCFM)	11.56 (408.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.66)
TOT FLOW STD. CU. METRES(SCF)	1532.4 (54109.)
HC SAMPLE METER/RANGE/PPM	27.2/ 3/272.00
HC BCKGRD METER/RANGE/PPM	2.3/ 3/23.00
CO SAMPLE METER/RANGE/PPM	62.8/12/ 61.97
CO BCKGRD METER/RANGE/PPM	2.4/12/ 2.34
CO2 SAMPLE METER/RANGE/PCT	77.1/12/.1587
CO2 BCKGRD METER/RANGE/PCT	22.8/12/.0422
NOX SAMPLE METER/RANGE/PPM	6.9/ 1/ 2.07
NOX BCKGRD METER/RANGE/PPM	1.2/ 1/ .36
DILUTION FACTOR	60.10
HC CONCENTRATION PPM	249.38
CO CONCENTRATION PPM	58.28
CO2 CONCENTRATION PCT	.1172
NOX CONCENTRATION PPM	1.72
HC MASS GRAMS	508.63
CO MASS GRAMS	103.975
CO2 MASS GRAMS	3287.24
NOX MASS GRAMS	5.142
MASS OF FUEL BURNED GRAMS	3020.69
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.000)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE
GRAMS/TEST 1.472
GRAMS/KG FUEL .49
GRAMS/KM ******
GRAMS/MILE ******

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 3.021 (6.661)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

FILTER EFF. 76.31

TABLE B-3. C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 73. PCT

DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
ABS. HUMIDITY 12.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	90.13 (3182.5)
TOT. 20X20 RATE SCMM (SCFM)	11.64 (411.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.64)
TOT FLOW STD. CU. METRES(SCF)	1527.5 (53935.)
HC SAMPLE METER/RANGE/PPM	32.8/24/327.81
HC BCKGRD METER/RANGE/PPM	16.0/ 2/16.00
CO SAMPLE METER/RANGE/PPM	72.1/12/ 71.63
CO BCKGRD METER/RANGE/PPM	6.2/12/ 6.03
CO2 SAMPLE METER/RANGE/PCT	84.0/12/.1773
CO2 BCKGRD METER/RANGE/PCT	27.6/12/.0503
NOX SAMPLE METER/RANGE/PPM	9.3/31/ 2.78
NOX BCKGRD METER/RANGE/PPM	3.5/ 1/ 1.05
DILUTION FACTOR	53.15
HC CONCENTRATION PPM	312.11
CO CONCENTRATION PPM	63.78
CO2 CONCENTRATION PCT	.1279
NOX CONCENTRATION PPM	1.70
HC MASS GRAMS	634.51
CO MASS GRAMS	113.419
CO2 MASS GRAMS	3577.34
NOX MASS GRAMS	5.087
MASS OF FUEL BURNED GRAMS	3368.57
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.000)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE
GRAMS/TEST 1.642
GRAMS/KG FUEL .49
GRAMS/KM ******
GRAMS/MILE ******

:V

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 3.369 (7.428)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

FILTER EFF. 78.56

TABLE B-3 (CONT'D). C-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 1 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 73. PCT

DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
ABS. HUMIDITY 12.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	C-IDLE
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	90.13 (3182.5)
TOT. 20X20 RATE SCMM (SCFM)	11.64 (411.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.64)
TOT FLOW STD. CU. METRES(SCF)	1527.5 (53935.)
HC SAMPLE METER/RANGE/PPM	26.6/ 3/266.00
HC BCKGRD METER/RANGE/PPM	2.3/ 3/23.00
CO SAMPLE METER/RANGE/PPM	72.1/12/ 71.63
CO BCKGRD METER/RANGE/PPM	6.2/12/ 6.03
CO2 SAMPLE METER/RANGE/PCT	84.0/12/.1773
CO2 BCKGRD METER/RANGE/PCT	27.6/12/.0503
NOX SAMPLE METER/RANGE/PPM	10.1/ 1/ 3.03
NOX BCKGRD METER/RANGE/PPM	3.5/ 1/ 1.05
DILUTION FACTOR	54.70
HC CONCENTRATION PPM	243.42
CO CONCENTRATION PPM	63.78
CO2 CONCENTRATION PCT	.1279
NOX CONCENTRATION PPM	2.00
HC MASS GRAMS	494.87
CO MASS GRAMS	113.413
CO2 MASS GRAMS	3576.59
NOX MASS GRAMS	6.000
MASS OF FUEL BURNED GRAMS	3228.37
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.000)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

C-IDLE COMPOSITE RESULTS

HC GRAMS/KM (GRAMS/MILE)	***** (*****)	PARTICULATE RATE
CO GRAMS/KM (GRAMS/MILE)	****** (******)	GRAMS/TEST 1.642
CO2 GRAMS/KM (GRAMS/MILE)	******* (*******)	GRAMS/KG FUEL .51
NOX GRAMS/KM (GRAMS/MILE)	***** (*****)	GRAMS/KM ******
		GRAMS/MILE ******
TOTAL DISTANCE KM (MILES)	.00 (.00)	
FUEL CONSUMPTION KG (LB)	3.228 (7.119)	FILTER EFF. 78.56
FUEL ECONOMY L/100KM (MPG)	****** (.00)	

TABLE B-4. 12.5 VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 2 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 741.17 MM HG(29.18 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	12.5
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.60 (3163.8)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1517.4 (53580.)
HC SAMPLE METER/RANGE/PPM	31.3/24/313.41
HC BCKGRD METER/RANGE/PPM	1.8/ 4/18.00
CO SAMPLE METER/RANGE/PPM	43.2/13/ 99.58
CO BCKGRD METER/RANGE/PPM	1.9/13/ 4.16
CO2 SAMPLE METER/RANGE/PCT	53.6/13/.2260
CO2 BCKGRD METER/RANGE/PCT	13.0/13/.0497
NOX SAMPLE METER/RANGE/PPM	8.3/31/ 2.49
NOX BCKGRD METER/RANGE/PPM	2.4/ 1/ .72
DILUTION FACTOR	43.21
HC CONCENTRATION PPM	295.82
CO CONCENTRATION PPM	92.87
CO2 CONCENTRATION PCT	.1774
NOX CONCENTRATION PPM	1.72
HC MASS GRAMS	597.45
CO MASS GRAMS	164.067
CO2 MASS GRAMS	4928.15
NOX MASS GRAMS	5.267
MASS OF FUEL BURNED GRAMS	4372.84
MEASURED DISTANCE KM (MILES)	5.086 (3.161)
FUEL ECONOMY L/100KM (MPG)	107.80 (2.182)
HC GRAMS/KM (GRAMS/MILE)	117.46 (188.99)
CO GRAMS/KM (GRAMS/MILE)	32.26 (51.90)
CO2 GRAMS/KM (GRAMS/MILE)	968.9 (1558.9)
NOX GRAMS/KM (GRAMS/MILE)	1.04 (1.67)

12.5 COMPOSITE RESULTS

CONT. HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	32.26 (51.90)
CO2	GRAMS/KM (GRAMS/MILE)	968.88 (1558.94)
CONT. NOX	GRAMS/KM (GRAMS/MILE)	1.04 (1.67)

PARTICULATE RATE

GRAMS/TEST	2.344
GRAMS/KG FUEL	.54
GRAMS/KM	.46
GRAMS/MILE	.74

TOTAL DISTANCE KM (MILES)	5.09 (3.16)
FUEL CONSUMPTION KG (LB)	4.373 (9.642)
FUEL ECONOMY L/100KM (MPG)	107.80 (2.18)

FILTER EFF. 77.32

TABLE B-4 (CONT'D). 12.5 VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 2 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 741.17 MM HG(29.18 IN HG)
RELATIVE HUMIDITY 64. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 13.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

TEST CYCLE	12.5
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.60 (3163.8)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1517.4 (53580.)
HC SAMPLE METER/RANGE/PPM	27.0/ 3/270.00
HC BCKGRD METER/RANGE/PPM	3.7/ 3/37.00
CO SAMPLE METER/RANGE/PPM	43.2/13/ 99.58
CO BCKGRD METER/RANGE/PPM	1.9/13/ 4.16
CO2 SAMPLE METER/RANGE/PCT	53.6/13/.2260
CO2 BCKGRD METER/RANGE/PCT	13.0/13/.0497
NOX SAMPLE METER/RANGE/PPM	11.3/ 1/ 3.39
NOX BCKGRD METER/RANGE/PPM	2.4/ 1/ .72
DILUTION FACTOR	43.92
HC CONCENTRATION PPM	233.84
CO CONCENTRATION PPM	92.87
CO2 CONCENTRATION PCT	.1774
NOX CONCENTRATION PPM	2.69
HC MASS GRAMS	472.27
CO MASS GRAMS	164.064
CO2 MASS GRAMS	4927.63
NOX MASS GRAMS	8.204
MASS OF FUEL BURNED GRAMS	4247.28
MEASURED DISTANCE KM (MILES)	5.086 (3.161)
FUEL ECONOMY L/100KM (MPG)	104.71 (2.247)
HC GRAMS/KM (GRAMS/MILE)	92.85 (149.40)
CO GRAMS/KM (GRAMS/MILE)	32.26 (51.90)
CO2 GRAMS/KM (GRAMS/MILE)	968.8 (1558.8)
NOX GRAMS/KM (GRAMS/MILE)	1.61 (2.60)

12.5 COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	92.85 (*****)
CO	GRAMS/KM (GRAMS/MILE)	32.26 (51.90)
CO2	GRAMS/KM (GRAMS/MILE)	968.78 (1558.77)
NOX	GRAMS/KM (GRAMS/MILE)	1.61 (2.60)

TOTAL DISTANCE KM (MILES)	5.09 (3.16)
FUEL CONSUMPTION KG (LB)	4.247 (9.365)
FUEL ECONOMY L/100KM (MPG)	104.71 (2.25)

PARTICULATE RATE

GRAMS/TEST	2.344
GRAMS/KG FUEL	.55
GRAMS/KM	.46
GRAMS/MILE	.74

FILTER EFF. 77.32

TABLE B-5. 12.5 VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 2 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 57. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 11.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	12.5
RUN TIME SECONDS	900.2
TOT. BLOWER RATE SCMM (SCFM)	89.42 (3157.5)
TOT. 20X20 RATE SCMM (SCFM)	11.51 (406.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.71)
TOT FLOW STD. CU. METRES(SCF)	1515.0 (53494.)
HC SAMPLE METER/RANGE/PPM	34.4/24/343.93
HC BCKGRD METER/RANGE/PPM	1.8/ 4/18.00
CO SAMPLE METER/RANGE/PPM	44.4/13/102.52
CO BCKGRD METER/RANGE/PPM	1.9/13/ 4.16
CO2 SAMPLE METER/RANGE/PCT	53.3/13/.2245
CO2 BCKGRD METER/RANGE/PCT	12.6/13/.0482
NOX SAMPLE METER/RANGE/PPM	9.9/31/ 2.96
NOX BCKGRD METER/RANGE/PPM	2.5/ 1/ .75
DILUTION FACTOR	42.90
HC CONCENTRATION PPM	326.35
CO CONCENTRATION PPM	95.97
CO2 CONCENTRATION PCT	.1775
NOX CONCENTRATION PPM	2.16
HC MASS GRAMS	658.04
CO MASS GRAMS	169.263
CO2 MASS GRAMS	4923.79
NOX MASS GRAMS	6.403
MASS OF FUEL BURNED GRAMS	4436.19
MEASURED DISTANCE KM (MILES)	5.358 (3.330)
FUEL ECONOMY L/100KM (MPG)	103.83 (2.266)
HC GRAMS/KM (GRAMS/MILE)	122.82 (197.62)
CO GRAMS/KM (GRAMS/MILE)	31.59 (50.83)
CO2 GRAMS/KM (GRAMS/MILE)	919.0 (1478.7)
NOX GRAMS/KM (GRAMS/MILE)	1.20 (1.92)

12.5 COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	31.59 (50.83)
	CO2	GRAMS/KM (GRAMS/MILE)	919.04 (1478.74)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	1.20 (1.92)

PARTICULATE RATE

GRAMS/TEST	1.663
GRAMS/KG FUEL	.37
GRAMS/KM	.31
GRAMS/MILE	.50

TOTAL DISTANCE KM (MILES)	5.36 (3.33)
FUEL CONSUMPTION KG (LB)	4.436 (9.782)
FUEL ECONOMY L/100KM (MPG)	103.83 (2.27)

FILTER EFF. 81.78

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TABLE B-5 (CONT'D). 12.5 VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 2 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 57. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 11.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	12.5
RUN TIME SECONDS	900.2
TOT. BLOWER RATE SCMM (SCFM)	89.42 (3157.5)
TOT. 20X20 RATE SCMM (SCFM)	11.51 (406.3)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.71)
TOT FLOW STD. CU. METRES(SCF)	1515.0 (53494.)
HC SAMPLE METER/RANGE/PPM	31.5/ 3/315.00
HC BCKGRD METER/RANGE/PPM	2.0/ 3/20.00
CO SAMPLE METER/RANGE/PPM	44.4/13/102.52
CO BCKGRD METER/RANGE/PPM	1.9/13/ 4.16
CO2 SAMPLE METER/RANGE/PCT	53.3/13/.2245
CO2 BCKGRD METER/RANGE/PCT	12.6/13/.0482
NOX SAMPLE METER/RANGE/PPM	11.5/ 1/ 3.45
NOX BCKGRD METER/RANGE/PPM	2.5/ 1/ .75
DILUTION FACTOR	43.36
HC CONCENTRATION PPM	295.46
CO CONCENTRATION PPM	95.97
CO2 CONCENTRATION PCT	.1775
NOX CONCENTRATION PPM	2.72
HC MASS GRAMS	595.76
CO MASS GRAMS	169.261
CO2 MASS GRAMS	4923.45
NOX MASS GRAMS	8.050
MASS OF FUEL BURNED GRAMS	4373.67
MEASURED DISTANCE KM (MILES)	5.358 (3.330)
FUEL ECONOMY L/100KM (MPG)	102.37 (2.298)
HC GRAMS/KM (GRAMS/MILE)	111.20 (178.92)
CO GRAMS/KM (GRAMS/MILE)	31.59 (50.83)
CO2 GRAMS/KM (GRAMS/MILE)	919.0 (1478.6)
NOX GRAMS/KM (GRAMS/MILE)	1.50 (2.42)

12.5 COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	31.59 (50.83)
CO2	GRAMS/KM (GRAMS/MILE)	918.98 (1478.64)
NOX	GRAMS/KM (GRAMS/MILE)	1.50 (2.42)
TOTAL DISTANCE KM (MILES)		5.36 (3.33)
FUEL CONSUMPTION KG (LB)		4.374 (9.644)
FUEL ECONOMY L/100KM (MPG)		102.37 (2.30)

PARTICULATE RATE

GRAMS/TEST	1.663
GRAMS/KG FUEL	.38
GRAMS/KM	.31
GRAMS/MILE	.50
FILTER EFF.	81.78

TABLE B-6. 12.5 VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 2 RUN 3	VEHICLE NO. 2	TEST WEIGHT 14787. KG(32600. LBS)
VEHICLE MODEL 1983 GMC METHANOL	DATE 7/24/85	ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
ENGINE 9.0 L(552. CID) V-6	BAG CART NO. 2	METHANOL EM-BUS-F
TRANSMISSION A-3	DYNO NO. 4	ODOMETER 0. KM(0. MILES)
GVW12996. KG(28650. LBS)	CVS NO. 11	
BAROMETER 738.63 MM HG(29.08 IN HG)	DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)	
RELATIVE HUMIDITY 65. PCT	ABS. HUMIDITY 11.7 GM/KG	NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	12.5
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.06 (3144.5)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.59)
TOT FLOW STD. CU. METRES(SCF)	1509.2 (53289.)
HC SAMPLE METER/RANGE/PPM	34.0/24/340.12
HC BCKGRD METER/RANGE/PPM	16.0/ 2/16.00
CO SAMPLE METER/RANGE/PPM	99.9/12/100.65
CO BCKGRD METER/RANGE/PPM	5.4/12/ 5.26
CO2 SAMPLE METER/RANGE/PCT	53.1/13/.2236
CO2 BCKGRD METER/RANGE/PCT	12.1/13/.0462
NOX SAMPLE METER/RANGE/PPM	10.0/31/ 3.01
NOX BCKGRD METER/RANGE/PPM	2.2/ 1/ .66
DILUTION FACTOR	43.14
HC CONCENTRATION PPM	324.50
CO CONCENTRATION PPM	92.82
CO2 CONCENTRATION PCT	.1785
NOX CONCENTRATION PPM	2.31
HC MASS GRAMS	651.79
CO MASS GRAMS	163.073
CO2 MASS GRAMS	4931.65
NOX MASS GRAMS	6.780
MASS OF FUEL BURNED GRAMS	4428.59
MEASURED DISTANCE KM (MILES)	5.156 (3.204)
FUEL ECONOMY L/100KM (MPG)	107.71 (2.184)
HC GRAMS/KM (GRAMS/MILE)	126.42 (203.40)
CO GRAMS/KM (GRAMS/MILE)	31.63 (50.89)
CO2 GRAMS/KM (GRAMS/MILE)	956.5 (1539.0)
NOX GRAMS/KM (GRAMS/MILE)	1.31 (2.12)

12.5 COMPOSITE RESULTS

CONT. HC GRAMS/KM (GRAMS/MILE)	***** (*****)	PARTICULATE RATE
CO GRAMS/KM (GRAMS/MILE)	31.63 (50.89)	GRAMS/TEST 1.108
CO2 GRAMS/KM (GRAMS/MILE)	956.50 (1539.01)	GRAMS/KG FUEL .25
CONT. NOX GRAMS/KM (GRAMS/MILE)	1.31 (2.12)	GRAMS/KM .21
		GRAMS/MILE .35
TOTAL DISTANCE KM (MILES)	5.16 (3.20)	
FUEL CONSUMPTION KG (LB)	4.429 (9.765)	FILTER EFF. 85.27
FUEL ECONOMY L/100KM (MPG)	107.71 (2.18)	

TABLE B-6 (CONT'D). 12.5 VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 2 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 65. PCT

DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)
ABS. HUMIDITY 11.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	12.5
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.06 (3144.5)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.59)
TOT FLOW STD. CU. METRES(SCF)	1509.2 (53289.)
HC SAMPLE METER/RANGE/PPM	31.0/ 3/310.00
HC BCKGRD METER/RANGE/PPM	2.3/ 3/23.00
CO SAMPLE METER/RANGE/PPM	99.9/12/100.65
CO BCKGRD METER/RANGE/PPM	5.4/12/ 5.26
CO2 SAMPLE METER/RANGE/PCT	53.1/13/.2236
CO2 BCKGRD METER/RANGE/PCT	12.1/13/.0462
NOX SAMPLE METER/RANGE/PPM	11.5/ 1/ 3.45
NOX BCKGRD METER/RANGE/PPM	2.2/ 1/ .66
DILUTION FACTOR	43.63
HC CONCENTRATION PPM	287.53
CO CONCENTRATION PPM	92.82
CO2 CONCENTRATION PCT	.1785
NOX CONCENTRATION PPM	2.81
HC MASS GRAMS	577.54
CO MASS GRAMS	163.071
CO2 MASS GRAMS	4931.31
NOX MASS GRAMS	8.243
MASS OF FUEL BURNED GRAMS	4354.09
MEASURED DISTANCE KM (MILES)	5.156 (3.204)
FUEL ECONOMY L/100KM (MPG)	105.89 (2.221)
HC GRAMS/KM (GRAMS/MILE)	112.01 (180.23)
CO GRAMS/KM (GRAMS/MILE)	31.63 (50.89)
CO2 GRAMS/KM (GRAMS/MILE)	956.4 (1538.9)
NOX GRAMS/KM (GRAMS/MILE)	1.60 (2.57)

12.5 COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	31.63 (50.89)
CO2	GRAMS/KM (GRAMS/MILE)	956.44 (1538.91)
NOX	GRAMS/KM (GRAMS/MILE)	1.60 (2.57)

PARTICULATE RATE

GRAMS/TEST	1.108
GRAMS/KG FUEL	.25
GRAMS/KM	.21
GRAMS/MILE	.35

TOTAL DISTANCE KM (MILES)	5.16 (3.20)
FUEL CONSUMPTION KG (LB)	4.354 (9.601)
FUEL ECONOMY L/100KM (MPG)	105.89 (2.22)

FILTER EFF. 85.27

TABLE B-7. 25 MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 3 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.92 MM HG(29.17 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 14.3 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.07

BAG RESULTS

TEST CYCLE	25 MPH
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	89.71 (3167.6)
TOT. 20X20 RATE SCMM (SCFM)	11.45 (404.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.54)
TOT FLOW STD. CU. METRES(SCF)	1518.0 (53601.)
HC SAMPLE METER/RANGE/PPM	54.2/24/542.24
HC BCKGRD METER/RANGE/PPM	2.0/ 4/20.00
CO SAMPLE METER/RANGE/PPM	70.1/13/168.29
CO BCKGRD METER/RANGE/PPM	3.1/13/ 6.79
CO2 SAMPLE METER/RANGE/PCT	76.8/13/.3400
CO2 BCKGRD METER/RANGE/PCT	14.2/13/.0545
NOX SAMPLE METER/RANGE/PPM	22.2/31/ 6.66
NOX BCKGRD METER/RANGE/PPM	3.4/ 1/ 1.02
DILUTION FACTOR	28.10
HC CONCENTRATION PPM	522.96
CO CONCENTRATION PPM	156.81
CO2 CONCENTRATION PCT	.2874
NOX CONCENTRATION PPM	5.51
HC MASS GRAMS	1056.58
CO MASS GRAMS	277.125
CO2 MASS GRAMS	7988.13
NOX MASS GRAMS	17.113
MASS OF FUEL BURNED GRAMS	7188.97
MEASURED DISTANCE KM (MILES)	10.246 (6.368)
FUEL ECONOMY L/100KM (MPG)	87.98 (2.674)
HC GRAMS/KM (GRAMS/MILE)	103.12 (165.91)
CO GRAMS/KM (GRAMS/MILE)	27.05 (43.52)
CO2 GRAMS/KM (GRAMS/MILE)	779.6 (1254.4)
NOX GRAMS/KM (GRAMS/MILE)	1.67 (2.69)

25 MPH COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	27.05 (43.52)
	CO2	GRAMS/KM (GRAMS/MILE)	779.60 (1254.38)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	1.67 (2.69)

PARTICULATE RATE

GRAMS/TEST	2.504
GRAMS/KG FUEL	.35
GRAMS/KM	.24
GRAMS/MILE	.39

TOTAL DISTANCE KM (MILES)	10.25 (6.37)
FUEL CONSUMPTION KG (LB)	7.189 (15.852)
FUEL ECONOMY L/100KM (MPG)	87.98 (2.67)

FILTER EFF. 82.57

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TABLE B-7 (CONT'D). 25 MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 3 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.92 MM HG(29.17 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 14.3 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.07

BAG RESULTS

	25 MPH
TEST CYCLE	
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	89.71 (3167.6)
TOT. 20X20 RATE SCMM (SCFM)	11.45 (404.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.54)
TOT FLOW STD. CU. METRES(SCF)	1518.0 (53601.)
HC SAMPLE METER/RANGE/PPM	44.7/ 3/447.00
HC BCKGRD METER/RANGE/PPM	4.0/ 3/40.00
CO SAMPLE METER/RANGE/PPM	70.1/13/168.29
CO BCKGRD METER/RANGE/PPM	3.1/13/ 6.79
CO2 SAMPLE METER/RANGE/PCT	76.8/13/.3400
CO2 BCKGRD METER/RANGE/PCT	14.2/13/.0545
NOX SAMPLE METER/RANGE/PPM	21.7/ 1/ 6.51
NOX BCKGRD METER/RANGE/PPM	3.4/ 1/ 1.02
DILUTION FACTOR	28.77
HC CONCENTRATION PPM	408.39
CO CONCENTRATION PPM	156.81
CO2 CONCENTRATION PCT	.2874
NOX CONCENTRATION PPM	5.53
HC MASS GRAMS	825.11
CO MASS GRAMS	277.115
CO2 MASS GRAMS	7986.88
NOX MASS GRAMS	17.173
MASS OF FUEL BURNED GRAMS	6956.58
MEASURED DISTANCE KM (MILES)	10.246 (6.368)
FUEL ECONOMY L/100KM (MPG)	85.13 (2.763)
HC GRAMS/KM (GRAMS/MILE)	80.53 (129.57)
CO GRAMS/KM (GRAMS/MILE)	27.04 (43.52)
CO2 GRAMS/KM (GRAMS/MILE)	779.5 (1254.2)
NOX GRAMS/KM (GRAMS/MILE)	1.68 (2.70)

25 MPH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	80.53 (*****)
CO	GRAMS/KM (GRAMS/MILE)	27.04 (43.52)
CO2	GRAMS/KM (GRAMS/MILE)	779.48 (1254.18)
NOX	GRAMS/KM (GRAMS/MILE)	1.68 (2.70)

PARTICULATE RATE

GRAMS/TEST	2.504
GRAMS/KG FUEL	.36
GRAMS/KM	.24
GRAMS/MILE	.39

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TOTAL DISTANCE KM (MILES)	10.25 (6.37)
FUEL CONSUMPTION KG (LB)	6.957 (15.339)
FUEL ECONOMY L/100KM (MPG)	85.13 (2.76)

FILTER EFF. 82.57

TABLE B-8. 25 MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 3 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 48. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 11.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	25 MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.38 (3156.1)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.55)
TOT FLOW STD. CU. METRES(SCF)	1514.1 (53462.)
HC SAMPLE METER/RANGE/PPM	54.5/24/545.06
HC BCKGRD METER/RANGE/PPM	1.7/ 4/17.00
CO SAMPLE METER/RANGE/PPM	71.0/13/170.69
CO BCKGRD METER/RANGE/PPM	3.8/13/ 8.33
CO2 SAMPLE METER/RANGE/PCT	77.0/13/.3410
CO2 BCKGRD METER/RANGE/PCT	14.1/13/.0541
NOX SAMPLE METER/RANGE/PPM	23.2/31/ 6.97
NOX BCKGRD METER/RANGE/PPM	4.2/ 1/ 1.26
DILUTION FACTOR	27.99
HC CONCENTRATION PPM	528.67
CO CONCENTRATION PPM	158.38
CO2 CONCENTRATION PCT	.2888
NOX CONCENTRATION PPM	5.61
HC MASS GRAMS	1065.36
CO MASS GRAMS	279.164
CO2 MASS GRAMS	8006.32
NOX MASS GRAMS	16.396
MASS OF FUEL BURNED GRAMS	7213.32
MEASURED DISTANCE KM (MILES)	10.244 (6.367)
FUEL ECONOMY L/100KM (MPG)	88.30 (2.664)
HC GRAMS/KM (GRAMS/MILE)	104.00 (167.34)
CO GRAMS/KM (GRAMS/MILE)	27.25 (43.85)
CO2 GRAMS/KM (GRAMS/MILE)	781.6 (1257.6)
NOX GRAMS/KM (GRAMS/MILE)	1.60 (2.58)

25 MPH COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	27.25 (43.85)
CONT.	CO2	GRAMS/KM (GRAMS/MILE)	781.58 (1257.57)
	NOX	GRAMS/KM (GRAMS/MILE)	1.60 (2.58)

PARTICULATE RATE

GRAMS/TEST	1.535
GRAMS/KG FUEL	.21
GRAMS/KM	.15
GRAMS/MILE	.24

TOTAL DISTANCE KM (MILES)	10.24 (6.37)
FUEL CONSUMPTION KG (LB)	7.213 (15.905)
FUEL ECONOMY L/100KM (MPG)	88.30 (2.66)

FILTER EFF. 83.83

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TABLE B-8 (CONT'D). 25 MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 3 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 48. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 11.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	25 MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.38 (3156.1)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.55)
TOT FLOW STD. CU. METRES(SCF)	1514.1 (53462.)
HC SAMPLE METER/RANGE/PPM	48.3/ 3/483.00
HC BCKGRD METER/RANGE/PPM	2.5/ 3/25.00
CO SAMPLE METER/RANGE/PPM	71.0/13/170.69
CO BCKGRD METER/RANGE/PPM	3.8/13/ 8.33
CO2 SAMPLE METER/RANGE/PCT	77.0/13/.3410
CO2 BCKGRD METER/RANGE/PCT	14.1/13/.0541
NOX SAMPLE METER/RANGE/PPM	23.7/ 1/ 7.11
NOX BCKGRD METER/RANGE/PPM	4.2/ 1/ 1.26
DILUTION FACTOR	28.42
HC CONCENTRATION PPM	458.88
CO CONCENTRATION PPM	158.37
CO2 CONCENTRATION PCT	.2888
NOX CONCENTRATION PPM	5.89
HC MASS GRAMS	924.72
CO MASS GRAMS	279.156
CO2 MASS GRAMS	8005.51
NOX MASS GRAMS	17.220
MASS OF FUEL BURNED GRAMS	7072.09
MEASURED DISTANCE KM (MILES)	10.244 (6.367)
FUEL ECONOMY L/100KM (MPG)	86.57 (2.717)
HC GRAMS/KM (GRAMS/MILE)	90.27 (145.25)
CO GRAMS/KM (GRAMS/MILE)	27.25 (43.85)
CO2 GRAMS/KM (GRAMS/MILE)	781.5 (1257.4)
NOX GRAMS/KM (GRAMS/MILE)	1.68 (2.70)

25 MPH COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	90.27 (*****)
CO	GRAMS/KM (GRAMS/MILE)	27.25 (43.85)
CO2	GRAMS/KM (GRAMS/MILE)	781.51 (1257.44)
NOX	GRAMS/KM (GRAMS/MILE)	1.68 (2.70)

TOTAL DISTANCE KM (MILES)	10.24 (6.37)
FUEL CONSUMPTION KG (LB)	7.072 (15.594)
FUEL ECONOMY L/100KM (MPG)	86.57 (2.72)

PARTICULATE RATE

GRAMS/TEST	1.535
GRAMS/KG FUEL	.22
GRAMS/KM	.15
GRAMS/MILE	.24

FILTER EFF. 83.83

TABLE B-9. 25 MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 3 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 62. PCT

DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 11.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	25 MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.03 (3143.8)
TOT. 20X20 RATE SCMM (SCFM)	11.47 (405.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	1508.4 (53263.)
HC SAMPLE METER/RANGE/PPM	59.1/24/590.82
HC BCKGRD METER/RANGE/PPM	20.0/ 2/20.00
CO SAMPLE METER/RANGE/PPM	66.4/13/158.50
CO BCKGRD METER/RANGE/PPM	2.3/13/ 5.04
CO2 SAMPLE METER/RANGE/PCT	75.8/13/.3349
CO2 BCKGRD METER/RANGE/PCT	13.0/13/.0497
NOX SAMPLE METER/RANGE/PPM	21.0/31/ 6.30
NOX BCKGRD METER/RANGE/PPM	2.8/ 1/ .84
DILUTION FACTOR	28.18
HC CONCENTRATION PPM	571.53
CO CONCENTRATION PPM	148.97
CO2 CONCENTRATION PCT	.2869
NOX CONCENTRATION PPM	5.36
HC MASS GRAMS	1147.44
CO MASS GRAMS	261.605
CO2 MASS GRAMS	7924.42
NOX MASS GRAMS	15.665
MASS OF FUEL BURNED GRAMS	7215.69
MEASURED DISTANCE KM (MILES)	10.304 (6.404)
FUEL ECONOMY L/100KM (MPG)	87.81 (2.679)
HC GRAMS/KM (GRAMS/MILE)	111.36 (179.17)
CO GRAMS/KM (GRAMS/MILE)	25.39 (40.85)
CO2 GRAMS/KM (GRAMS/MILE)	769.0 (1237.4)
NOX GRAMS/KM (GRAMS/MILE)	1.52 (2.45)

25 MPH COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	25.39 (40.85)
CONT.	CO2	GRAMS/KM (GRAMS/MILE)	769.04 (1237.39)
	NOX	GRAMS/KM (GRAMS/MILE)	1.52 (2.45)

PARTICULATE RATE

GRAMS/TEST	1.779
GRAMS/KG FUEL	.25
GRAMS/KM	.17
GRAMS/MILE	.28

TOTAL DISTANCE KM (MILES)	10.30 (6.40)
FUEL CONSUMPTION KG (LB)	7.216 (15.911)
FUEL ECONOMY L/100KM (MPG)	87.81 (2.68)

FILTER EFF. 83.79

TABLE B-9 (CONT'D). 25 MPH VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 3 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 62. PCT

DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 11.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	25 MPH
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.03 (3143.8)
TOT. 20X20 RATE SCMM (SCFM)	11.47 (405.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	1508.4 (53263.)
HC SAMPLE METER/RANGE/PPM	51.7/ 3/517.00
HC BCKGRD METER/RANGE/PPM	2.9/ 3/29.00
CO SAMPLE METER/RANGE/PPM	66.4/13/158.50
CO BCKGRD METER/RANGE/PPM	2.3/13/ 5.04
CO2 SAMPLE METER/RANGE/PCT	75.8/13/.3349
CO2 BCKGRD METER/RANGE/PCT	13.0/13/.0497
NOX SAMPLE METER/RANGE/PPM	21.7/ 1/ 6.51
NOX BCKGRD METER/RANGE/PPM	2.8/ 1/ .84
DILUTION FACTOR	28.70
HC CONCENTRATION PPM	489.01
CO CONCENTRATION PPM	148.97
CO2 CONCENTRATION PCT	.2869
NOX CONCENTRATION PPM	5.70
HC MASS GRAMS	981.77
CO MASS GRAMS	261.599
CO2 MASS GRAMS	7923.54
NOX MASS GRAMS	16.665
MASS OF FUEL BURNED GRAMS	7049.38
MEASURED DISTANCE KM (MILES)	10.304 (6.404)
FUEL ECONOMY L/100KM (MPG)	85.79 (2.742)
HC GRAMS/KM (GRAMS/MILE)	95.28 (153.30)
CO GRAMS/KM (GRAMS/MILE)	25.39 (40.85)
CO2 GRAMS/KM (GRAMS/MILE)	769.0 (1237.3)
NOX GRAMS/KM (GRAMS/MILE)	1.62 (2.60)

25 MPH COMPOSITE RESULTS

HC GRAMS/KM (GRAMS/MILE)	95.28 (*****)
CO GRAMS/KM (GRAMS/MILE)	25.39 (40.85)
CO2 GRAMS/KM (GRAMS/MILE)	768.96 (1237.25)
NOX GRAMS/KM (GRAMS/MILE)	1.62 (2.60)
TOTAL DISTANCE KM (MILES)	10.30 (6.40)
FUEL CONSUMPTION KG (LB)	7.049 (15.544)
FUEL ECONOMY L/100KM (MPG)	85.79 (2.74)

PARTICULATE RATE

GRAMS/TEST	1.779
GRAMS/KG FUEL	.25
GRAMS/KM	.17
GRAMS/MILE	.28
FILTER EFF.	83.79

TABLE B-10. H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 4 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.92 MM HG(29.17 IN HG)
RELATIVE HUMIDITY 52. PCT

DRY BULB TEMP. 28.3 DEG C(83.0 DEG F)
ABS. HUMIDITY 13.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	89.22 (3150.4)
TOT. 20X20 RATE SCMM (SCFM)	11.44 (404.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1510.7 (53342.)
HC SAMPLE METER/RANGE/PPM	8.3/24/ 83.04
HC BCKGRD METER/RANGE/PPM	1.8/ 4/18.00
CO SAMPLE METER/RANGE/PPM	45.9/12/ 44.78
CO BCKGRD METER/RANGE/PPM	3.1/12/ 3.02
CO2 SAMPLE METER/RANGE/PCT	61.9/12/.1195
CO2 BCKGRD METER/RANGE/PCT	26.1/12/.0478
NOX SAMPLE METER/RANGE/PPM	2.8/31/ .83
NOX BCKGRD METER/RANGE/PPM	1.5/ 1/ .45
DILUTION FACTOR	87.30
HC CONCENTRATION PPM	65.25
CO CONCENTRATION PPM	40.92
CO2 CONCENTRATION PCT	.0722
NOX CONCENTRATION PPM	.37
HC MASS GRAMS	131.19
CO MASS GRAMS	71.971
CO2 MASS GRAMS	1997.09
NOX MASS GRAMS	1.108
MASS OF FUEL BURNED GRAMS	1667.41
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE
GRAMS/TEST .853
GRAMS/KG FUEL .51
GRAMS/KM ******
GRAMS/MILE ******

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 1.667 (3.677)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

FILTER EFF. 75.00

TABLE B-10 (CONT'D). H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 4 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.92 MM HG(29.17 IN HG)
RELATIVE HUMIDITY 52. PCT

DRY BULB TEMP. 28.3 DEG C(83.0 DEG F)
ABS. HUMIDITY 13.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	89.22 (3150.4)
TOT. 20X20 RATE SCMM (SCFM)	11.44 (404.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1510.7 (53342.)
HC SAMPLE METER/RANGE/PPM	8.7/ 3/ 87.00
HC BCKGRD METER/RANGE/PPM	2.4/ 3/24.00
CO SAMPLE METER/RANGE/PPM	45.9/12/ 44.78
CO BCKGRD METER/RANGE/PPM	3.1/12/ 3.02
CO2 SAMPLE METER/RANGE/PCT	61.9/12/.1195
CO2 BCKGRD METER/RANGE/PCT	26.1/12/.0478
NOX SAMPLE METER/RANGE/PPM	4.3/ 1/ 1.29
NOX BCKGRD METER/RANGE/PPM	3.4/ 1/ 1.02
DILUTION FACTOR	87.04
HC CONCENTRATION PPM	63.28
CO CONCENTRATION PPM	40.92
CO2 CONCENTRATION PCT	.0722
NOX CONCENTRATION PPM	.28
HC MASS GRAMS	127.22
CO MASS GRAMS	71.971
CO2 MASS GRAMS	1997.14
NOX MASS GRAMS	.850
MASS OF FUEL BURNED GRAMS	1663.48
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE

GRAMS/TEST	.853
GRAMS/KG FUEL	.51
GRAMS/KM	******
GRAMS/MILE	******

TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.663 (3.668)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

FILTER EFF. 75.00

TABLE B-11. H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 4 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 50. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 10.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.00

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	89.79 (3170.4)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.58)
TOT FLOW STD. CU. METRES(SCF)	1520.0 (53671.)
HC SAMPLE METER/RANGE/PPM	8.2/24/ 81.76
HC BCKGRD METER/RANGE/PPM	1.7/ 4/17.00
CO SAMPLE METER/RANGE/PPM	46.7/12/ 45.58
CO BCKGRD METER/RANGE/PPM	3.9/12/ 3.80
CO2 SAMPLE METER/RANGE/PCT	57.4/12/.1088
CO2 BCKGRD METER/RANGE/PCT	22.8/12/.0422
NOX SAMPLE METER/RANGE/PPM	3.8/31/ 1.13
NOX BCKGRD METER/RANGE/PPM	2.7/ 1/ .81
DILUTION FACTOR	94.97
HC CONCENTRATION PPM	64.94
CO CONCENTRATION PPM	41.00
CO2 CONCENTRATION PCT	.0670
NOX CONCENTRATION PPM	.31
HC MASS GRAMS	131.38
CO MASS GRAMS	72.553
CO2 MASS GRAMS	1865.89
NOX MASS GRAMS	.887
MASS OF FUEL BURNED GRAMS	1572.74
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE
GRAMS/TEST 1.046
GRAMS/KG FUEL .67
GRAMS/KM ******
GRAMS/MILE ******

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 1.573 (3.468)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

FILTER EFF. 85.95

TABLE B-11 (CONT'D). H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 4 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 50. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 10.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.00

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.0
TOT. BLOWER RATE SCMM (SCFM)	89.79 (3170.4)
TOT. 20X20 RATE SCMM (SCFM)	11.50 (406.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.58)
TOT FLOW STD. CU. METRES(SCF)	1520.0 (53671.)
HC SAMPLE METER/RANGE/PPM	76.4/ 2/ 76.40
HC BCKGRD METER/RANGE/PPM	14.4/ 2/14.40
CO SAMPLE METER/RANGE/PPM	46.7/12/ 45.58
CO BCKGRD METER/RANGE/PPM	3.9/12/ 3.80
CO2 SAMPLE METER/RANGE/PCT	57.4/12/.1088
CO2 BCKGRD METER/RANGE/PCT	22.8/12/.0422
NOX SAMPLE METER/RANGE/PPM	3.8/ 1/ 1.14
NOX BCKGRD METER/RANGE/PPM	2.7/ 1/ .81
DILUTION FACTOR	95.39
HC CONCENTRATION PPM	62.15
CO CONCENTRATION PPM	41.00
CO2 CONCENTRATION PCT	.0670
NOX CONCENTRATION PPM	.34
HC MASS GRAMS	125.73
CO MASS GRAMS	72.552
CO2 MASS GRAMS	1865.83
NOX MASS GRAMS	.979
MASS OF FUEL BURNED GRAMS	1567.06
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
CO	GRAMS/KM (GRAMS/MILE)	****** (******)
CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE
GRAMS/TEST 1.046
GRAMS/KG FUEL .67
GRAMS/KM ******
GRAMS/MILE ******

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 1.567 (3.455)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

FILTER EFF. 85.95

TABLE B-12. H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 4 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 23.9 DEG C(75.0 DEG F)
ABS. HUMIDITY 11.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.79 (3170.6)
TOT. 20X20 RATE SCMM (SCFM)	11.42 (403.4)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.63)
TOT FLOW STD. CU. METRES(SCF)	1519.1 (53641.)
HC SAMPLE METER/RANGE/PPM	8.5/24/ 85.43
HC BCKGRD METER/RANGE/PPM	19.0/ 2/19.00
CO SAMPLE METER/RANGE/PPM	47.9/12/ 46.79
CO BCKGRD METER/RANGE/PPM	3.1/12/ 3.02
CO2 SAMPLE METER/RANGE/PCT	57.4/12/.1088
CO2 BCKGRD METER/RANGE/PCT	22.1/12/.0410
NOX SAMPLE METER/RANGE/PPM	.9/31/ .28
NOX BCKGRD METER/RANGE/PPM	.1/ 1/ .03
DILUTION FACTOR	94.60
HC CONCENTRATION PPM	66.63
CO CONCENTRATION PPM	42.81
CO2 CONCENTRATION PCT	.0682
NOX CONCENTRATION PPM	.25
HC MASS GRAMS	134.72
CO MASS GRAMS	75.717
CO2 MASS GRAMS	1897.32
NOX MASS GRAMS	.728
MASS OF FUEL BURNED GRAMS	1602.59
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	***** (*****)
	CO	GRAMS/KM (GRAMS/MILE)	****** (******)
	CO2	GRAMS/KM (GRAMS/MILE)	******* (*******)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	***** (*****)

PARTICULATE RATE
GRAMS/TEST .897
GRAMS/KG FUEL .56
GRAMS/KM ******
GRAMS/MILE ******

TOTAL DISTANCE KM (MILES) .00 (.00)
FUEL CONSUMPTION KG (LB) 1.603 (3.534)
FUEL ECONOMY L/100KM (MPG) ****** (.00)

FILTER EFF. 73.48

TABLE B-12 (CONT'D). H-IDLE VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 4 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 23.9 DEG C(75.0 DEG F)
ABS. HUMIDITY 11.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	H-IDLE
RUN TIME SECONDS	900.1
TOT. BLOWER RATE SCMM (SCFM)	89.79 (3170.6)
TOT. 20X20 RATE SCMM (SCFM)	11.42 (403.4)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.63)
TOT FLOW STD. CU. METRES(SCF)	1519.1 (53641.)
HC SAMPLE METER/RANGE/PPM	77.2/ 2/ 77.20
HC BCKGRD METER/RANGE/PPM	20.3/ 2/20.30
CO SAMPLE METER/RANGE/PPM	47.9/12/ 46.79
CO BCKGRD METER/RANGE/PPM	3.1/12/ 3.02
CO2 SAMPLE METER/RANGE/PCT	57.4/12/.1088
CO2 BCKGRD METER/RANGE/PCT	22.1/12/.0410
NOX SAMPLE METER/RANGE/PPM	3.8/ 1/ 1.14
NOX BCKGRD METER/RANGE/PPM	2.4/ 1/ .72
DILUTION FACTOR	95.25
HC CONCENTRATION PPM	57.11
CO CONCENTRATION PPM	42.81
CO2 CONCENTRATION PCT	.0682
NOX CONCENTRATION PPM	.43
HC MASS GRAMS	115.48
CO MASS GRAMS	75.717
CO2 MASS GRAMS	1897.23
NOX MASS GRAMS	1.253
MASS OF FUEL BURNED GRAMS	1583.28
MEASURED DISTANCE KM (MILES)	.001 (.000)
FUEL ECONOMY L/100KM (MPG)	****** (.001)
HC GRAMS/KM (GRAMS/MILE)	******* (*******)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	****** (******)
NOX GRAMS/KM (GRAMS/MILE)	***** (******)

H-IDLE COMPOSITE RESULTS

HC GRAMS/KM (GRAMS/MILE)	***** (*****)
CO GRAMS/KM (GRAMS/MILE)	****** (******)
CO2 GRAMS/KM (GRAMS/MILE)	******* (*******)
NOX GRAMS/KM (GRAMS/MILE)	***** (*****)
TOTAL DISTANCE KM (MILES)	.00 (.00)
FUEL CONSUMPTION KG (LB)	1.583 (3.491)
FUEL ECONOMY L/100KM (MPG)	****** (.00)

PARTICULATE RATE

GRAMS/TEST	.897
GRAMS/KG FUEL	.57
GRAMS/KM	******
GRAMS/MILE	******
FILTER EFF.	73.48

TABLE B-13. CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 5 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 49. PCT

DRY BULB TEMP. 28.3 DEG C(83.0 DEG F)
ABS. HUMIDITY 12.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	587.2
TOT. BLOWER RATE SCMM (SCFM)	89.15 (3148.0)
TOT. 20X20 RATE SCMM (SCFM)	11.41 (402.8)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.60)
TOT FLOW STD. CU. METRES(SCF)	984.6 (34766.)
HC SAMPLE METER/RANGE/PPM	17.0/24/169.95
HC BCKGRD METER/RANGE/PPM	1.8/ 4/18.00
CO SAMPLE METER/RANGE/PPM	72.3/13/174.17
CO BCKGRD METER/RANGE/PPM	3.3/13/ 7.23
CO2 SAMPLE METER/RANGE/PCT	84.5/13/.3791
CO2 BCKGRD METER/RANGE/PCT	14.1/13/.0541
NOX SAMPLE METER/RANGE/PPM	9.6/12/ 9.61
NOX BCKGRD METER/RANGE/PPM	4.0/ 1/ 1.20
DILUTION FACTOR	27.93
HC CONCENTRATION PPM	152.59
CO CONCENTRATION PPM	162.55
CO2 CONCENTRATION PCT	.3270
NOX CONCENTRATION PPM	8.24
HC MASS GRAMS	199.97
CO MASS GRAMS	186.323
CO2 MASS GRAMS	5894.84
NOX MASS GRAMS	15.952
MASS OF FUEL BURNED GRAMS	4704.56
MEASURED DISTANCE KM (MILES)	3.307 (2.055)
FUEL ECONOMY L/100KM (MPG)	178.39 (1.319)
HC GRAMS/KM (GRAMS/MILE)	60.47 (97.29)
CO GRAMS/KM (GRAMS/MILE)	56.34 (90.65)
CO2 GRAMS/KM (GRAMS/MILE)	1782.5 (2868.1)
NOX GRAMS/KM (GRAMS/MILE)	4.82 (7.76)

CBD COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	60.47 (97.29)
	CO	GRAMS/KM (GRAMS/MILE)	56.34 (90.65)
	CO2	GRAMS/KM (GRAMS/MILE)	1782.54 (2868.10)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	4.82 (7.76)

PARTICULATE RATE

GRAMS/TEST	3.106
GRAMS/KG FUEL	.66
GRAMS/KM	.94
GRAMS/MILE	1.51

TOTAL DISTANCE KM (MILES)	3.31 (2.06)	
FUEL CONSUMPTION KG (LB)	4.705 (10.374)	FILTER EFF. 82.40
FUEL ECONOMY L/100KM (MPG)	178.39 (1.32)	

TABLE B-13 (CONT'D). CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 5 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 49. PCT

DRY BULB TEMP. 28.3 DEG C(83.0 DEG F)
ABS. HUMIDITY 12.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	587.2
TOT. BLOWER RATE SCMM (SCFM)	89.15 (3148.0)
TOT. 20X20 RATE SCMM (SCFM)	11.41 (402.8)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.60)
TOT FLOW STD. CU. METRES(SCF)	984.6 (34766.)
HC SAMPLE METER/RANGE/PPM	13.6/ 3/136.00
HC BCKGRD METER/RANGE/PPM	2.7/ 3/27.00
CO SAMPLE METER/RANGE/PPM	72.3/13/174.17
CO BCKGRD METER/RANGE/PPM	3.3/13/ 7.23
CO2 SAMPLE METER/RANGE/PCT	84.5/13/.3791
CO2 BCKGRD METER/RANGE/PCT	14.1/13/.0541
NOX SAMPLE METER/RANGE/PPM	33.5/ 1/10.05
NOX BCKGRD METER/RANGE/PPM	4.0/ 1/ 1.20
DILUTION FACTOR	28.16
HC CONCENTRATION PPM	109.96
CO CONCENTRATION PPM	162.55
CO2 CONCENTRATION PCT	.3270
NOX CONCENTRATION PPM	8.89
HC MASS GRAMS	144.10
CO MASS GRAMS	186.321
CO2 MASS GRAMS	5894.55
NOX MASS GRAMS	17.225
MASS OF FUEL BURNED GRAMS	4648.48
MEASURED DISTANCE KM (MILES)	3.307 (2.055)
FUEL ECONOMY L/100KM (MPG)	176.26 (1.335)
HC GRAMS/KM (GRAMS/MILE)	43.57 (70.11)
CO GRAMS/KM (GRAMS/MILE)	56.34 (90.65)
CO2 GRAMS/KM (GRAMS/MILE)	1782.4 (2868.0)
NOX GRAMS/KM (GRAMS/MILE)	5.21 (8.38)

CBD COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	43.57 (70.11)
CO	GRAMS/KM (GRAMS/MILE)	56.34 (90.65)
CO2	GRAMS/KM (GRAMS/MILE)	1782.45 (2867.96)
NOX	GRAMS/KM (GRAMS/MILE)	5.21 (8.38)

PARTICULATE RATE

GRAMS/TEST	3.106
GRAMS/KG FUEL	.67
GRAMS/KM	.94
GRAMS/MILE	1.51

TOTAL DISTANCE KM (MILES)	3.31 (2.06)
FUEL CONSUMPTION KG (LB)	4.648 (10.250)
FUEL ECONOMY L/100KM (MPG)	176.26 (1.33)

FILTER EFF. 82.40

TABLE B-14. CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 5 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 48. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 11.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	580.1
TOT. BLOWER RATE SCMM (SCFM)	89.50 (3160.4)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.58)
TOT FLOW STD. CU. METRES(SCF)	976.5 (34482.)
HC SAMPLE METER/RANGE/PPM	16.3/24/163.34
HC BCKGRD METER/RANGE/PPM	1.8/ 4/18.00
CO SAMPLE METER/RANGE/PPM	69.6/13/166.96
CO BCKGRD METER/RANGE/PPM	2.2/13/ 4.82
CO2 SAMPLE METER/RANGE/PCT	85.1/13/.3822
CO2 BCKGRD METER/RANGE/PCT	13.5/13/.0517
NOX SAMPLE METER/RANGE/PPM	10.3/12/10.33
NOX BCKGRD METER/RANGE/PPM	4.1/ 1/ 1.23
DILUTION FACTOR	27.81
HC CONCENTRATION PPM	145.99
CO CONCENTRATION PPM	157.88
CO2 CONCENTRATION PCT	.3324
NOX CONCENTRATION PPM	8.92
HC MASS GRAMS	189.74
CO MASS GRAMS	179.482
CO2 MASS GRAMS	5942.47
NOX MASS GRAMS	16.808
MASS OF FUEL BURNED GRAMS	4721.19
MEASURED DISTANCE KM (MILES)	3.391 (2.107)
FUEL ECONOMY L/100KM (MPG)	174.59 (1.347)
HC GRAMS/KM (GRAMS/MILE)	55.96 (90.03)
CO GRAMS/KM (GRAMS/MILE)	52.93 (85.16)
CO2 GRAMS/KM (GRAMS/MILE)	1752.5 (2819.7)
NOX GRAMS/KM (GRAMS/MILE)	4.96 (7.98)

		CBD COMPOSITE RESULTS
CONT. HC	GRAMS/KM (GRAMS/MILE)	55.96 (90.03)
CO	GRAMS/KM (GRAMS/MILE)	52.93 (85.16)
CO2	GRAMS/KM (GRAMS/MILE)	1752.45 (2819.70)
CONT. NOX	GRAMS/KM (GRAMS/MILE)	4.96 (7.98)
TOTAL DISTANCE KM (MILES)		3.39 (2.11)
FUEL CONSUMPTION KG (LB)		4.721 (10.410)
FUEL ECONOMY L/100KM (MPG)		174.59 (1.35)

PARTICULATE RATE
GRAMS/TEST 3.240
GRAMS/KG FUEL .69
GRAMS/KM .96
GRAMS/MILE 1.54

FILTER EFF. 85.48

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TABLE B-14 (CONT'D). CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 5 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 48. PCT

DRY BULB TEMP. 27.2 DEG C(81.0 DEG F)
ABS. HUMIDITY 11.2 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	580.1
TOT. BLOWER RATE SCMM (SCFM)	89.50 (3160.4)
TOT. 20X20 RATE SCMM (SCFM)	11.46 (404.5)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.58)
TOT FLOW STD. CU. METRES(SCF)	976.5 (34482.)
HC SAMPLE METER/RANGE/PPM	14.7/ 3/147.00
HC BCKGRD METER/RANGE/PPM	2.6/ 3/26.00
CO SAMPLE METER/RANGE/PPM	69.6/13/166.96
CO BCKGRD METER/RANGE/PPM	2.2/13/ 4.82
CO2 SAMPLE METER/RANGE/PCT	85.1/13/.3822
CO2 BCKGRD METER/RANGE/PCT	13.5/13/.0517
NOX SAMPLE METER/RANGE/PPM	35.1/ 1/10.53
NOX BCKGRD METER/RANGE/PPM	4.1/ 1/ 1.23
DILUTION FACTOR	27.92
HC CONCENTRATION PPM	121.93
CO CONCENTRATION PPM	157.87
CO2 CONCENTRATION PCT	.3324
NOX CONCENTRATION PPM	9.34
HC MASS GRAMS	158.48
CO MASS GRAMS	179.481
CO2 MASS GRAMS	5942.34
NOX MASS GRAMS	17.606
MASS OF FUEL BURNED GRAMS	4689.83
MEASURED DISTANCE KM (MILES)	3.391 (2.107)
FUEL ECONOMY L/100KM (MPG)	173.43 (1.356)
HC GRAMS/KM (GRAMS/MILE)	46.74 (75.20)
CO GRAMS/KM (GRAMS/MILE)	52.93 (85.16)
CO2 GRAMS/KM (GRAMS/MILE)	1752.4 (2819.6)
NOX GRAMS/KM (GRAMS/MILE)	5.19 (8.35)

CBD COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	46.74 (75.20)
CO	GRAMS/KM (GRAMS/MILE)	52.93 (85.16)
CO2	GRAMS/KM (GRAMS/MILE)	1752.42 (2819.64)
NOX	GRAMS/KM (GRAMS/MILE)	5.19 (8.35)

PARTICULATE RATE	
GRAMS/TEST	3.240
GRAMS/KG FUEL	.69
GRAMS/KM	.96
GRAMS/MILE	1.54

TOTAL DISTANCE KM (MILES)	3.39 (2.11)	
FUEL CONSUMPTION KG (LB)	4.690 (10.341)	FILTER EFF. 85.48
FUEL ECONOMY L/100KM (MPG)	173.43 (1.36)	

TABLE B-15. CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 5 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 11.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	586.0
TOT. BLOWER RATE SCMM (SCFM)	89.33 (3154.3)
TOT. 20X20 RATE SCMM (SCFM)	11.47 (405.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.60)
TOT FLOW STD. CU. METRES(SCF)	984.9 (34778.)
HC SAMPLE METER/RANGE/PPM	18.1/24/181.35
HC BCKGRD METER/RANGE/PPM	19.0/ 2/19.00
CO SAMPLE METER/RANGE/PPM	71.0/13/170.69
CO BCKGRD METER/RANGE/PPM	1.7/13/ 3.72
CO2 SAMPLE METER/RANGE/PCT	82.6/13/.3694
CO2 BCKGRD METER/RANGE/PCT	12.0/13/.0458
NOX SAMPLE METER/RANGE/PPM	9.6/12/ 9.58
NOX BCKGRD METER/RANGE/PPM	2.9/ 1/ .87
DILUTION FACTOR	28.55
HC CONCENTRATION PPM	163.02
CO CONCENTRATION PPM	162.02
CO2 CONCENTRATION PCT	.3253
NOX CONCENTRATION PPM	8.53
HC MASS GRAMS	213.70
CO MASS GRAMS	185.774
CO2 MASS GRAMS	5865.18
NOX MASS GRAMS	16.367
MASS OF FUEL BURNED GRAMS	4696.08
MEASURED DISTANCE KM (MILES)	3.357 (2.087)
FUEL ECONOMY L/100KM (MPG)	175.40 (1.341)
HC GRAMS/KM (GRAMS/MILE)	63.65 (102.42)
CO GRAMS/KM (GRAMS/MILE)	55.34 (89.03)
CO2 GRAMS/KM (GRAMS/MILE)	1747.0 (2811.0)
NOX GRAMS/KM (GRAMS/MILE)	4.88 (7.84)

CBD COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	63.65 (*****)
	CO	GRAMS/KM (GRAMS/MILE)	55.34 (89.03)
	CO2	GRAMS/KM (GRAMS/MILE)	1747.03 (2810.98)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	4.88 (7.84)

PARTICULATE RATE

GRAMS/TEST	3.321
GRAMS/KG FUEL	.71
GRAMS/KM	.99
GRAMS/MILE	1.59

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TOTAL DISTANCE KM (MILES)	3.36 (2.09)
FUEL CONSUMPTION KG (LB)	4.696 (10.355)
FUEL ECONOMY L/100KM (MPG)	175.40 (1.34)

FILTER EFF. 83.57

TABLE B-15 (CONT'D). CBD VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 5 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 11.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	CBD
RUN TIME SECONDS	586.0
TOT. BLOWER RATE SCMM (SCFM)	89.33 (3154.3)
TOT. 20X20 RATE SCMM (SCFM)	11.47 (405.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.60)
TOT FLOW STD. CU. METRES(SCF)	984.9 (34778.)
HC SAMPLE METER/RANGE/PPM	14.8/ 3/148.00
HC BCKGRD METER/RANGE/PPM	2.5/ 3/25.00
CO SAMPLE METER/RANGE/PPM	71.0/13/170.69
CO BCKGRD METER/RANGE/PPM	1.7/13/ 3.72
CO2 SAMPLE METER/RANGE/PCT	82.6/13/.3694
CO2 BCKGRD METER/RANGE/PCT	12.0/13/.0458
NOX SAMPLE METER/RANGE/PPM	33.1/ 1/ 9.93
NOX BCKGRD METER/RANGE/PPM	2.9/ 1/ .87
DILUTION FACTOR	28.78
HC CONCENTRATION PPM	123.87
CO CONCENTRATION PPM	162.01
CO2 CONCENTRATION PCT	.3252
NOX CONCENTRATION PPM	9.09
HC MASS GRAMS	162.38
CO MASS GRAMS	185.772
CO2 MASS GRAMS	5864.95
NOX MASS GRAMS	17.435
MASS OF FUEL BURNED GRAMS	4644.58
MEASURED DISTANCE KM (MILES)	3.357 (2.087)
FUEL ECONOMY L/100KM (MPG)	173.48 (1.356)
HC GRAMS/KM (GRAMS/MILE)	48.37 (77.82)
CO GRAMS/KM (GRAMS/MILE)	55.34 (89.03)
CO2 GRAMS/KM (GRAMS/MILE)	1747.0 (2810.9)
NOX GRAMS/KM (GRAMS/MILE)	5.19 (8.36)

		CBD	COMPOSITE RESULTS
HC	GRAMS/KM (GRAMS/MILE)	48.37 (77.82)	
CO	GRAMS/KM (GRAMS/MILE)	55.34 (89.03)	
CO2	GRAMS/KM (GRAMS/MILE)	1746.96 (2810.86)	
NOX	GRAMS/KM (GRAMS/MILE)	5.19 (8.36)	
TOTAL DISTANCE KM (MILES)		3.36 (2.09)	
FUEL CONSUMPTION KG (LB)		4.645 (10.241)	
FUEL ECONOMY L/100KM (MPG)		173.48 (1.36)	

PARTICULATE RATE
GRAMS/TEST 3.321
GRAMS/KG FUEL .72
GRAMS/KM .99
GRAMS/MILE 1.59

FILTER EFF. 83.57

TABLE B-16. BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 6 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-B7S-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 47. PCT

DRY BULB TEMP. 29.4 DEG C(85.0 DEG F)
ABS. HUMIDITY 12.6 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1192.1
TOT. BLOWER RATE SCMM (SCFM)	89.13 (3147.3)
TOT. 20X20 RATE SCMM (SCFM)	11.36 (401.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1997.5 (70533.)
HC SAMPLE METER/RANGE/PPM	13.5/24/134.69
HC BCKGRD METER/RANGE/PPM	1.6/ 4/16.00
CO SAMPLE METER/RANGE/PPM	72.7/13/175.24
CO BCKGRD METER/RANGE/PPM	3.1/13/ 6.79
CO2 SAMPLE METER/RANGE/PCT	70.8/13/.3098
CO2 BCKGRD METER/RANGE/PCT	14.4/13/.0553
NOX SAMPLE METER/RANGE/PPM	7.7/12/ 7.68
NOX BCKGRD METER/RANGE/PPM	4.7/ 1/ 1.41
DILUTION FACTOR	33.90
HC CONCENTRATION PPM	119.16
CO CONCENTRATION PPM	164.44
CO2 CONCENTRATION PCT	.2561
NOX CONCENTRATION PPM	6.14
HC MASS GRAMS	316.80
CO MASS GRAMS	382.399
CO2 MASS GRAMS	9367.54
NOX MASS GRAMS	24.267
MASS OF FUEL BURNED GRAMS	7573.84
MEASURED DISTANCE KM (MILES)	4.844 (3.011)
FUEL ECONOMY L/100KM (MPG)	196.05 (1.200)
HC GRAMS/KM (GRAMS/MILE)	65.40 (105.23)
CO GRAMS/KM (GRAMS/MILE)	78.94 (127.01)
CO2 GRAMS/KM (GRAMS/MILE)	1933.8 (3111.4)
NOX GRAMS/KM (GRAMS/MILE)	5.01 (8.06)

BUS COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	65.40 (*****)
	CO	GRAMS/KM (GRAMS/MILE)	78.94 (127.01)
	CO2	GRAMS/KM (GRAMS/MILE)	1933.76 (3111.42)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	5.01 (8.06)

PARTICULATE RATE

GRAMS/TEST	1.680
GRAMS/KG FUEL	.22
GRAMS/KM	.35
GRAMS/MILE	.56

TOTAL DISTANCE KM (MILES)	4.84 (3.01)
FUEL CONSUMPTION KG (LB)	7.574 (16.700)
FUEL ECONOMY L/100KM (MPG)	196.05 (1.20)

FILTER EFF. 83.43

TABLE B-16 (CONT'D). BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 6 RUN 1
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/22/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-B7S-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 47. PCT

DRY BULB TEMP. 29.4 DEG C(85.0 DEG F)
ABS. HUMIDITY 12.6 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1192.1
TOT. BLOWER RATE SCMM (SCFM)	89.13 (3147.3)
TOT. 20X20 RATE SCMM (SCFM)	11.36 (401.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.62)
TOT FLOW STD. CU. METRES(SCF)	1997.5 (70533.)
HC SAMPLE METER/RANGE/PPM	11.9/ 3/119.00
HC BCKGRD METER/RANGE/PPM	2.6/ 3/26.00
CO SAMPLE METER/RANGE/PPM	72.7/13/175.24
CO BCKGRD METER/RANGE/PPM	3.1/13/ 6.79
CO2 SAMPLE METER/RANGE/PCT	70.8/13/.3098
CO2 BCKGRD METER/RANGE/PCT	14.4/13/.0553
NOX SAMPLE METER/RANGE/PPM	27.7/ 1/ 8.31
NOX BCKGRD METER/RANGE/PPM	4.7/ 1/ 1.41
DILUTION FACTOR	34.05
HC CONCENTRATION PPM	93.76
CO CONCENTRATION PPM	164.44
CO2 CONCENTRATION PCT	.2561
NOX CONCENTRATION PPM	6.94
HC MASS GRAMS	249.28
CO MASS GRAMS	382.397
CO2 MASS GRAMS	9367.27
NOX MASS GRAMS	27.439
MASS OF FUEL BURNED GRAMS	7506.11
MEASURED DISTANCE KM (MILES)	4.844 (3.011)
FUEL ECONOMY L/100KM (MPG)	194.30 (1.211)
HC GRAMS/KM (GRAMS/MILE)	51.46 (82.80)
CO GRAMS/KM (GRAMS/MILE)	78.94 (127.01)
CO2 GRAMS/KM (GRAMS/MILE)	1933.7 (3111.3)
NOX GRAMS/KM (GRAMS/MILE)	5.66 (9.11)

BUS COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	51.46 (82.80)
CO	GRAMS/KM (GRAMS/MILE)	78.94 (127.01)
CO2	GRAMS/KM (GRAMS/MILE)	1933.71 (3111.33)
NOX	GRAMS/KM (GRAMS/MILE)	5.66 (9.11)

TOTAL DISTANCE KM (MILES)	4.84 (3.01)
FUEL CONSUMPTION KG (LB)	7.506 (16.551)
FUEL ECONOMY L/100KM (MPG)	194.30 (1.21)

PARTICULATE RATE

GRAMS/TEST	1.680
GRAMS/KG FUEL	.22
GRAMS/KM	.35
GRAMS/MILE	.56
FILTER EFF.	83.43

TABLE B-17. BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 6 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.16 MM HG(29.14 IN HG)
RELATIVE HUMIDITY 44. PCT

DRY BULB TEMP. 29.4 DEG C(85.0 DEG F)
ABS. HUMIDITY 11.8 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1197.1
TOT. BLOWER RATE SCMM (SCFM)	89.36 (3155.2)
TOT. 20X20 RATE SCMM (SCFM)	11.44 (404.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	2012.0 (71044.)
HC SAMPLE METER/RANGE/PPM	15.3/24/152.53
HC BCKGRD METER/RANGE/PPM	1.7/ 4/17.00
CO SAMPLE METER/RANGE/PPM	72.6/13/174.98
CO BCKGRD METER/RANGE/PPM	2.5/13/ 5.47
CO2 SAMPLE METER/RANGE/PCT	67.8/13/.2948
CO2 BCKGRD METER/RANGE/PCT	13.0/13/.0497
NOX SAMPLE METER/RANGE/PPM	7.2/12/ 7.16
NOX BCKGRD METER/RANGE/PPM	4.0/ 1/ 1.20
DILUTION FACTOR	35.26
HC CONCENTRATION PPM	136.01
CO CONCENTRATION PPM	165.67
CO2 CONCENTRATION PCT	.2465
NOX CONCENTRATION PPM	5.84
HC MASS GRAMS	364.22
CO MASS GRAMS	388.049
CO2 MASS GRAMS	9081.22
NOX MASS GRAMS	22.904
MASS OF FUEL BURNED GRAMS	7419.28
MEASURED DISTANCE KM (MILES)	4.919 (3.057)
FUEL ECONOMY L/100KM (MPG)	189.12 (1.244)
HC GRAMS/KM (GRAMS/MILE)	74.04 (119.13)
CO GRAMS/KM (GRAMS/MILE)	78.88 (126.93)
CO2 GRAMS/KM (GRAMS/MILE)	1846.1 (2970.3)
NOX GRAMS/KM (GRAMS/MILE)	4.66 (7.49)

BUS COMPOSITE RESULTS

CONT.	HC	GRAMS/KM (GRAMS/MILE)	74.04 (*****)
	CO	GRAMS/KM (GRAMS/MILE)	78.88 (126.93)
	CO2	GRAMS/KM (GRAMS/MILE)	1846.07 (2970.33)
CONT.	NOX	GRAMS/KM (GRAMS/MILE)	4.66 (7.49)

TOTAL DISTANCE KM (MILES)	4.92 (3.06)
FUEL CONSUMPTION KG (LB)	7.419 (16.360)
FUEL ECONOMY L/100KM (MPG)	189.12 (1.24)

PARTICULATE RATE

GRAMS/TEST	2.012
GRAMS/KG FUEL	.27
GRAMS/KM	.41
GRAMS/MILE	.66

FILTER EFF. 84.16

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TABLE B-17 (CONT'D). BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-7774-010

TEST NO. 6 RUN 2
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/23/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 740.16 MM HG(29.14 IN HG)
RELATIVE HUMIDITY 44. PCT

DRY BULB TEMP. 29.4 DEG C(85.0 DEG F)
ABS. HUMIDITY 11.8 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1197.1
TOT. BLOWER RATE SCMM (SCFM)	89.36 (3155.2)
TOT. 20X20 RATE SCMM (SCFM)	11.44 (404.1)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.04 (1.57)
TOT FLOW STD. CU. METRES(SCF)	2012.0 (71044.)
HC SAMPLE METER/RANGE/PPM	15.1/ 3/151.00
HC BCKGRD METER/RANGE/PPM	2.0/ 3/20.00
CO SAMPLE METER/RANGE/PPM	72.6/13/174.98
CO BCKGRD METER/RANGE/PPM	2.5/13/ 5.47
CO2 SAMPLE METER/RANGE/PCT	67.8/13/.2948
CO2 BCKGRD METER/RANGE/PCT	13.0/13/.0497
NOX SAMPLE METER/RANGE/PPM	26.7/ 1/ 8.01
NOX BCKGRD METER/RANGE/PPM	4.0/ 1/ 1.20
DILUTION FACTOR	35.27
HC CONCENTRATION PPM	131.57
CO CONCENTRATION PPM	165.67
CO2 CONCENTRATION PCT	.2465
NOX CONCENTRATION PPM	6.84
HC MASS GRAMS	352.32
CO MASS GRAMS	388.049
CO2 MASS GRAMS	9081.20
NOX MASS GRAMS	26.852
MASS OF FUEL BURNED GRAMS	7407.36
MEASURED DISTANCE KM (MILES)	4.919 (3.057)
FUEL ECONOMY L/100KM (MPG)	188.82 (1.246)
HC GRAMS/KM (GRAMS/MILE)	71.62 (115.24)
CO GRAMS/KM (GRAMS/MILE)	78.88 (126.93)
CO2 GRAMS/KM (GRAMS/MILE)	1846.1 (2970.3)
NOX GRAMS/KM (GRAMS/MILE)	5.46 (8.78)

BUS COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	71.62 (*****)
CO	GRAMS/KM (GRAMS/MILE)	78.88 (126.93)
CO2	GRAMS/KM (GRAMS/MILE)	1846.07 (2970.33)
NOX	GRAMS/KM (GRAMS/MILE)	5.46 (8.78)

PARTICULATE RATE

GRAMS/TEST	2.012
GRAMS/KG FUEL	.27
GRAMS/KM	.41
GRAMS/MILE	.66

TOTAL DISTANCE KM (MILES)	4.92 (3.06)
FUEL CONSUMPTION KG (LB)	7.407 (16.333)
FUEL ECONOMY L/100KM (MPG)	188.82 (1.25)

FILTER EFF. 84.16

TABLE B-18. BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-774- 010

TEST NO. 6 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 11.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1199.2
TOT. BLOWER RATE SCMM (SCFM)	89.19 (3149.2)
TOT. 20X20 RATE SCMM (SCFM)	11.45 (404.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.61)
TOT FLOW STD. CU. METRES(SCF)	2012.3 (71053.)
HC SAMPLE METER/RANGE/PPM	16.8/24/167.87
HC BCKGRD METER/RANGE/PPM	14.0/ 2/14.00
CO SAMPLE METER/RANGE/PPM	71.3/13/171.49
CO BCKGRD METER/RANGE/PPM	2.1/13/ 4.60
CO2 SAMPLE METER/RANGE/PCT	67.6/13/.2939
CO2 BCKGRD METER/RANGE/PCT	11.5/13/.0438
NOX SAMPLE METER/RANGE/PPM	7.6/12/ 7.58
NOX BCKGRD METER/RANGE/PPM	3.3/ 1/ .99
DILUTION FACTOR	35.24
HC CONCENTRATION PPM	154.27
CO CONCENTRATION PPM	162.32
CO2 CONCENTRATION PCT	.2513
NOX CONCENTRATION PPM	6.45
HC MASS GRAMS	413.17
CO MASS GRAMS	380.256
CO2 MASS GRAMS	9256.86
NOX MASS GRAMS	25.289
MASS OF FUEL BURNED GRAMS	7587.17
MEASURED DISTANCE KM (MILES)	4.980 (3.095)
FUEL ECONOMY L/100KM (MPG)	191.03 (1.231)
HC GRAMS/KM (GRAMS/MILE)	82.96 (133.48)
CO GRAMS/KM (GRAMS/MILE)	76.35 (122.85)
CO2 GRAMS/KM (GRAMS/MILE)	1858.6 (2990.6)
NOX GRAMS/KM (GRAMS/MILE)	5.08 (8.17)

		BUS COMPOSITE RESULTS
CONT.	HC GRAMS/KM (GRAMS/MILE)	82.96 (*****)
	CO GRAMS/KM (GRAMS/MILE)	76.35 (122.85)
	CO2 GRAMS/KM (GRAMS/MILE)	1858.64 (2990.55)
CONT.	NOX GRAMS/KM (GRAMS/MILE)	5.08 (8.17)

PARTICULATE RATE
GRAMS/TEST 2.073
GRAMS/KG FUEL .27
GRAMS/KM .42
GRAMS/MILE .67

TOTAL DISTANCE KM (MILES) 4.98 (3.10)
FUEL CONSUMPTION KG (LB) 7.587 (16.730)
FUEL ECONOMY L/100KM (MPG) 191.03 (1.23)

FILTER EFF. 84.15

TABLE B-18 (CONT'D). BUS VEHICLE EMISSIONS RESULTS
PROJECT 03-774- 010

TEST NO. 6 RUN 3
VEHICLE MODEL 1983 GMC METHANOL
ENGINE 9.0 L(552. CID) V-6
TRANSMISSION A-3
GVW12996. KG(28650. LBS)

VEHICLE NO. 2
DATE 7/24/85
BAG CART NO. 2
DYNO NO. 4
CVS NO. 11

TEST WEIGHT 14787. KG(32600. LBS)
ACTUAL ROAD LOAD 59.7 KW(80.0 HP)
METHANOL EM-BUS-F
ODOMETER 0. KM(0. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 59. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 11.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.02

BAG RESULTS

TEST CYCLE	BUS
RUN TIME SECONDS	1199.2
TOT. BLOWER RATE SCMM (SCFM)	89.19 (3149.2)
TOT. 20X20 RATE SCMM (SCFM)	11.45 (404.2)
TOT. AUX. SAMPLE RATE SCMM (SCFM)	.05 (1.61)
TOT FLOW STD. CU. METRES(SCF)	2012.3 (71053.)
HC SAMPLE METER/RANGE/PPM	13.8/ 3/138.00
HC BCKGRD METER/RANGE/PPM	2.0/ 3/20.00
CO SAMPLE METER/RANGE/PPM	71.3/13/171.49
CO BCKGRD METER/RANGE/PPM	2.1/13/ 4.60
CO2 SAMPLE METER/RANGE/PCT	67.6/13/.2939
CO2 BCKGRD METER/RANGE/PCT	11.5/13/.0438
NOX SAMPLE METER/RANGE/PPM	26.5/ 1/ 7.95
NOX BCKGRD METER/RANGE/PPM	3.3/ 1/ .99
DILUTION FACTOR	35.57
HC CONCENTRATION PPM	118.56
CO CONCENTRATION PPM	162.32
CO2 CONCENTRATION PCT	.2513
NOX CONCENTRATION PPM	6.99
HC MASS GRAMS	317.53
CO MASS GRAMS	380.253
CO2 MASS GRAMS	9256.44
NOX MASS GRAMS	27.382
MASS OF FUEL BURNED GRAMS	7491.23
MEASURED DISTANCE KM (MILES)	4.980 (3.095)
FUEL ECONOMY L/100KM (MPG)	188.61 (1.247)
HC GRAMS/KM (GRAMS/MILE)	63.76 (102.58)
CO GRAMS/KM (GRAMS/MILE)	76.35 (122.85)
CO2 GRAMS/KM (GRAMS/MILE)	1858.6 (2990.4)
NOX GRAMS/KM (GRAMS/MILE)	5.50 (8.85)

BUS COMPOSITE RESULTS

HC	GRAMS/KM (GRAMS/MILE)	63.76 (*****)
CO	GRAMS/KM (GRAMS/MILE)	76.35 (122.85)
CO2	GRAMS/KM (GRAMS/MILE)	1858.56 (2990.42)
NOX	GRAMS/KM (GRAMS/MILE)	5.50 (8.85)

PARTICULATE RATE

GRAMS/TEST	2.073
GRAMS/KG FUEL	.28
GRAMS/KM	.42
GRAMS/MILE	.67

TOTAL DISTANCE KM (MILES)	4.98 (3.10)
FUEL CONSUMPTION KG (LB)	7.491 (16.518)
FUEL ECONOMY L/100KM (MPG)	188.61 (1.25)

FILTER EFF. 84.15

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16. ABSTRACT

Exhaust emissions from the two methanol-powered buses used in the California Methanol Bus Demonstration have been characterized. The M.A.N. SU 240 bus is powered by M.A.N.'s D2566 FMUH methanol engine, and utilizes catalytic exhaust aftertreatment. The GMC RTS II 04 bus is powered by a first-generation DDAD 6V-92TA methanol engine without exhaust aftertreatment. Emissions of HC, CO, NO_x, unburned methanol, aldehydes, total particulates, and soluble fraction of particulate were determined for both buses over steady-state and transient chassis dynamometer test cycles. Emission levels from the M.A.N. bus were considerably lower than those from the GMC bus, with the exception of NO_x. Comparison of emission levels from methanol- and diesel-powered buses indicates that substantial reduction in emissions (especially particulate and NO_x) are possible with careful implementation of methanol fueling.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Methanol Alternate Fuel Usage Diesel Cycle on Methanol Methanol Vehicle Testing Emission Characterization	Methanol Bus California Methanol Bus Program M.A.N. Methanol Bus GMC Methanol Bus Emissions	Bus Methanol Mass Transportation Emissions

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