

JOINT PROJECT AGREEMENT

BETWEEN

**HER MAJESTY THE QUEEN IN RIGHT OF CANADA as represented by the
MINISTER OF THE ENVIRONMENT** whose address is:

Emissions Research & Measurement Division
Environment Canada
Environmental Science and Technology Centre
335 River Road, Ottawa.
Ontario, Canada, K1A 0H3

(Hereinafter called "EC")

AND

City of Edmonton
Mobile Equipment Services Branch
12404 - 107 Street
4th Floor, Westwood
Edmonton, Alberta T5J 2R7

(Hereinafter called "The Company")

WHEREAS

(a) EC will provide support to The Company in the form of conducting exhaust emission measurements on 4 diesel powered urban transit buses and 6 diesel-electric hybrid urban transit buses while operated on a heavy duty chassis dynamometer

(b) The Company will provide the vehicles to be tested, fuel (ULSD), vehicle operators, state of charge measurement during Hybrid testing and a sum of \$57,114.60 plus applicable taxes to support the testing.

THEREFORE, the parties agree as follows:

DEFINITIONS

THC (total hydrocarbons), CO (carbon monoxide), NO_x and NO (oxides of nitrogen and nitric oxide),

Hydrocarbons (HC), Carbon dioxide (CO₂), and Total Particulate Matter (TPM).

CEPA – Canadian Environmental Protection Act

ULSD – Ultra Low Sulfur Diesel

MESB – Mobile Equipment Services Branch

U of A – University of Alberta

QA/QC – Quality Assurance/Quality Control

ERMD – Emissions Research and Measurement Division

CFR – Code of Federal Regulations

Participants: Environment Canada (EC), Edmonton Transit System – Mobile Equipment Services Branch (MEBS), University of Alberta (U of A)

STATEMENT OF WORK

Test Program Description

Test Cycles:

The test cycle to be used for the exhaust emissions measurements is a thirteen-mode chassis dynamometer steady-state test cycle (modes chosen by project partners). Two consecutive repeats of the thirteen-mode steady-state test cycle will be performed in order to collect emissions and engine performance data. Each test mode will be approximately 10 minutes in duration with 5 minutes between each test in order to change filters and prep for the next test.

Exhaust components to be measured:

Emissions used for comparison will include Hydrocarbons (HC), Oxides of Nitrogen (NO_x), Carbon Monoxide (CO), Carbon dioxide (CO₂), and Total Particulate Matter (TPM). TPM will be determined gravimetrically over each mode. Gaseous data will be collected in a Tedlar™ bag over each ten minute test mode and subsequently analyzed at the analyzer bench.

TPM will be determined using **Emfab 47 mm** filter count -> Approximately 10 buses * 13 modes * 2 repeats =260 plus tunnel blanks and spares.

Engine/Vehicle operating data that will be reported during each test may include engine speed, exhaust temperature, and air intake volume. Environment Canada will report fuel consumption based upon the accepted carbon balance method. MESB/U of A will ensure that ECM data is logged and made available to EC personnel.

Additional Data-Logging Required

Data logging of the analyzer bench as well as mass flow controllers will take place via an Omega data logger and the national instruments computer.

Test Vehicles

- A. 2006 Orion-BAE series diesel-electric hybrids * 2
- B. 2006 New Flyer-ISE series diesel-electric hybrids * 2
- C. 2006 New Flyer-Allison parallel diesel-electric hybrid * 2
- D. 2006 New Flyer diesel buses (baseline for Hybrids)
- E. 2007 New Flyer diesel buses
- F. 2 older technology buses

Test Fuel

To be provided by MESB (ULSD)

Fuel Exchange (if required): To be performed by MESB

TEST PROCEDURE:

ERMD will co-ordinate the test schedule with MESB/U of A. During the evaluation, the ERMD test team, which will consist of two EC staff, will travel to the test location with the test instrumentation. MESB/U of A will provide a site within a building, where the ERMD can set-up the emissions analysis systems. This building is in close proximity to the testing as the samples are analyzed after each test.

Upon arrival the team will install the sampling instrumentation on the test vehicle, and conduct performance and calibration checks of the systems prior to the actual test, and undertake a calibration of the analyzer bench. The emissions evaluation will commence following the standard QA/QC procedures. Detailed test protocols will be outlined in the test report.

1. Install laminar flow element on air intake and record air intake at various engine speeds with no load on the engine.
2. Conduct two consecutive test runs collecting emissions and engine performance data. Each test run would be approximately 15 minutes in duration
3. Between each run the raw data will be evaluated for completeness by checking that all data acquisition systems performed as expected. Acceptability criteria for the emission concentrations and engine operating readings will be based upon limits established during trial runs of the equipment.

Before initiating each test run the vehicle should be operated over the test cycle as a warm-up to ensure that the engine oil and exhaust temperatures are in the same range at the start of each test.

The engine operating parameters recorded by EC during the test can include the following:

Parameter	Method
Engine Speed	to be determined by vehicle/engine configuration
Exhaust Temperature	K type thermocouple
Ambient temperature	T type thermocouple
Vehicle Speed	Hall Effect Sensor

SAMPLING SYSTEM AND TEST PROTOCOLS:

To be provided in final report

TEST REPORTING AND COSTS:

The program will commence in July 2007 and testing will be completed by August 25, 2007. At the conclusion of the project the ERMD will prepare a report outlining the test procedures and describing the exhaust emission analysis results. The cost sharing required from the project team for the ERMD to undertake this project is outlined in the attached table. The final report and respective results for each participant will be provided upon receipt of funds as outlined in the Table below.

1. The ERMD will be required to use a portion of the funding for the provision of specialized analytical services for the sampling and analysis of exhaust emissions from the engines.
2. Sample/analysis consumables e.g. sample media, reference gases, chemicals, demurrage charges, etc.
3. Operational consumables e.g. fuels, electrical power, test system service agreements, test system modifications, materials for sample system fabrication, rental/lease charges for instrumentation, etc.

4. Provision of specialized services e.g. vehicle/engine set-up and modifications, emissions sampling and analysis, test system fabrication, fuel analysis, etc.
5. Travel and living expenses for the test team while undertaking the full emission test evaluation

Evaluation of Exhaust Emissions from Six Hybrid and 4 Diesel Urban Transit Buses

Fee Schedule based on testing over a TWO week time period:

Description	Item cost	Break down	Budget Cost CDN\$	Budget Cost CDN\$
Shipping and Ground Transportation	\$3,740.00	Test program	\$3,740.00	\$3,740.00
Travel	\$800.00	Per person	*2	\$1,600.00
Hotel	Est. \$120.00	Per day	* 26	\$3,120.00
Living expenses	\$76.95	Per person per day	* 28	\$2,154.60
Emissions testing (vehicle set-up, calibration of instruments, regulated sampling, etc.)	\$2,000.00	Per set of test modes	*20	\$40,000.00
Analyzer gases	\$3,500.00	Test Program	\$3,500.00	\$3,500.00
Set-up, Communication and Miscellaneous	\$1,000.00	Test Program	\$1,000.00	\$1,000.00
Report and Data Analysis	\$2,000.00	Test Program	\$2,000.00	\$2,000.00
	Sub-Total			\$57,114.60 CDN
	GST			\$3,426.88
	Project Total			\$60,541.48 CDN

NOTE: If a fuel analysis is required payment to the Alberta Research Council must be provided directly from MESB.

Costs for an additional week are estimated to be \$5,200.00 (Plus applicable taxes). These additional costs do not include any additional test vehicles.

Costs

The funding received from The Company will/may be used for the following purposes:

1. Operational consumables such as electrical power, materials and components for sample system fabrication, rental/lease charges for instrumentation, instrumentation service contracts
2. Capital items such as offsetting replacement costs of laboratory instrumentation due to normal wear and tear, specialized equipment necessary for the completion of the required work. Environment Canada will retain ownership of these capital items should they be purchased.

3. Laboratory consumables such as high purity gases, calibration gases, chemicals, sample media and its preparation, general laboratory supplies.
4. Provision of specialized services e.g. vehicle/engine set-up and modifications, emissions sampling and analysis, test system fabrication, fuel analysis, etc.
5. Laboratory/facility modifications and maintenance e.g. air handling/exhaust system modifications and calibrations, electrical power connections, etc.

The Company is in agreement that the funding provided for this program can be used in part or completely to purchase a capital item(s) and that this/these item(s) is to be owned by Environment Canada at the completion of the project.

Payment is required in the form of a certified cheque made out to the Receiver General for Canada, as per the following schedule:

1. Completion of the exhaust emissions testing: \$50,000.00
2. Receipt of the draft final report: \$10,541.48

HEALTH AND SAFETY REQUIREMENTS

EC will comply with all known host, Provincial/local and Federal regulations relating to safety at the test facility. This includes use of personal protective gear (e.g., safety glasses, hard hats, hearing protection, safety toed shoes) as required by the host and completion of site safety orientation (i.e., site hazard awareness, alarms and signals).

LOCATION OF PROJECT

Test Location: Cummins Western Canada
11751 181st Street NW,
Edmonton, Alberta T5S 2K5

INTELLECTUAL PROPERTY

EC will be the co – owner of any data and other information resulting from this Agreement.

GENERAL

The Company shall indemnify and save harmless EC, its employees and agents, from and against, and be responsible from, all claims, demands, losses, costs including solicitor and client costs, damages, actions, suits or proceedings, all in any manner based upon, arising out of, related to, occasioned by or attributable to any acts or conduct of The Company, its employees, agents, whether by reason of negligence or otherwise.

In the event that one party defaults or breaches any of the provisions of this Agreement, the other party shall have the right to terminate this Agreement by giving written notice to the defaulting party. However, if the defaulting party cures the breach within sixty (60) days after the notice is given, this Agreement shall continue in full force and effect.

The Agreement, at the option of EC, may be terminated forthwith by EC if:

- (a) the Company alters its share voting control in any manner that is considered detrimental to the interests of EC; or

- (b) the Company assigns any or all of its rights under this Agreement in any manner and for any purpose, except as may be expressly provided under this Agreement, without the prior written consent of EC.

EC may terminate this Agreement without notice if the Company becomes bankrupt, or insolvent, or has a receiving order made against it, or has a receiver appointed to continue its operations, or passes a resolution for winding up, or takes the benefit of any statutes relating to bankrupt or insolvent debtors or the orderly payment of debts.

Termination of this Agreement for any reason shall not release any party from any obligations which accrued while the Agreement was in force.

A failure by any of the parties to assert rights arising from any breach or default of this Agreement or an acceptance of payments shall not be regarded as a waiver of rights. No waiver or toleration implies any continuing or future waiver of rights.

It is a condition of this Agreement that no member of the House of Commons shall be admitted to any share or part of this Agreement or to any benefit to arise from it.

No former public office holder who is not in compliance with the "Conflict of Interest and Post-Employment Code for Public Office Holders" shall derive a direct benefit from this Agreement.

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to the Company: City of Edmonton
Mobile Equipment Services Branch
12404 - 107 Street
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to EC: Environment Canada
Environmental Science and Technology Centre
Emissions Research & Measurement Division
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Ontario, Canada. K1A 0H3

This Agreement shall be interpreted according to the laws of the Province of Ontario, Canada.

PERIOD OF AGREEMENT

This Agreement shall remain in effect until March 2008 unless cancelled by either party upon 30 days written notice.

HER MAJESTY THE QUEEN IN RIGHT OF CANADA as represented by the MINISTER OF THE ENVIRONMENT, at the City of Ottawa , in the Province of _____, this _____ day of _____, 2007.

By: Fred Hendren
Title: Chief, ERMD

By: Greg Rideout
Title: Program Manager

THE COMPANY, at the City of _____, in the Province of _____, this _____ day of _____, 2007.

(corporate seal)

By:
Title:

“Interest calculated and compounded monthly at the Bank of Canada rate plus 3% is payable on all overdue accounts”.

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Environmental Science and Technology Centre
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By: Fred Hendren
Title: Chief, ERMD

By: Greg Rideout
Title: Program Manager

THE COMPANY, at the City of _____, in the Province of _____, this _____ day of _____, 2007.