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July 18, 2008

To: Environmental Protection Agency
Cincinnati Procurement Operations Division
26 West Martin Luther King Drive
Cincinnati, OH 45268

Attention: Ms. Tammy Thomas
Contract Officer

From: Kevin Whitney
Emissions Research and Development Department
Southwest Research Institute (SwRI®)
P.O. Drawer 28510
San Antonio, Texas 78228-0510

Subject: Work Plan for Work Assignment 1-04, EPA Contract EP-C-07-028, under SwRI Project 03.14175, SwRI Proposal No. 03-53262.

Contract Title: "Testing and Related Support for Energy Bill-Mandated Activities"

Assignment Title: "Comprehensive Gasoline Light Duty Exhaust Fuel Effects Test Program to Cover Multiple Fuel Properties and Two Ambient Test Temperatures"

1.0 INTRODUCTION

Section 1506 of the Energy Policy Act of 2005 (Energy Act) requires EPA to produce an updated fuel effects model representing the 2007 light duty gasoline fleet, including determination of the emissions impacts of increased renewable fuel use.

The use of ethanol in gasoline has increased more than five-fold since 2000, and it is likely that its use will continue to expand into the next decade. It is also likely that use of high-level blends such as E85 will expand significantly.

Additionally, recent investigation related to the Mobile Source Air Toxics (MSAT2) rulemaking has shown that hydrocarbon emissions from light duty gasoline vehicles increase significantly as test temperature is decreased. As a result, the MSAT2 rulemaking promulgated NMHC standards at 20°F. However, this being a relatively new area of study, fuel effects data at temperatures lower than 75°F is scarce for use in emissions models.

Hydrocarbon (HC) emissions are composed of hundreds of compounds, some of which have been identified by the EPA as air toxics. The Clean Air Act directs EPA to set standards to reduce air toxics emissions. Most existing data on the fractional relationship between the various air toxics and HC emissions has been established using vehicles meeting Tier 0 emissions standards (now more than 10 years old), and burning fuels that did not contain ethanol.

In order to help EPA develop a better understanding of the impact of ethanol fuel blends on light duty vehicle emissions, Southwest Research Institute will conduct Work Assignment 1-04, "Comprehensive Gasoline Light Duty Exhaust Fuel Effects Test Program to Cover Multiple Fuel Properties and Two Ambient Test Temperatures". SwRI will comply with the requirements of Work Assignment 1-04 as described in the EPA Statement of Work.

2.0 OBJECTIVES

The objective of Work Assignment (WA) 1-04 is to procure, analyze, and store 16 test fuels for testing to be covered under WA 1-03, which has yet to be issued to SwRI. Additionally, this WA includes the procurement of Fuel 19, which is needed to complete WAs 1-01 and 1-02.

3.0 SCOPE OF WORK

This work assignment requires that SwRI procure a total of 17 test fuels. It is expected that this WA can be completed during the existing contract year. It should be noted that the budget estimate attached to this Work Plan assumes that fuel procurement will proceed without interruption or delay. Based on our experience procuring fuels under WA 0-01, SwRI anticipates that the fuel specifications may be altered at the request of EPA. Such EPA-requested changes may results in additional costs and project delays that cannot be anticipated by SwRI and are not accounted for in this Work Plan. Details of the project are presented below.

3.1 Work Plan Development

This document represents the current Work Plan.

3.2 Quality Assurance Project Plan and Quality Management Plan (QAPP/QMP)

The Quality Assurance Project Plan submitted for WA 0-01 will remain in effect for the Work Assignment. It will be modified as necessary for this WA.

3.3 Test Fuels

SwRI will procure, analyze, and store 17 test fuels under this WA. These fuels are referred to as Fuels 1 through 16, and Fuel 19. Fuel 19 will be used to conduct WAs 1-01 and 1-02, while Fuels 1 through 16 will be used to conduct WA 1-03. These fuels will be procured from Haltermann Products. Fuel procurement is expected to include the arrangement, facilitation, and supervision of meetings between EPA and Haltermann including teleconferences and on-site visits at Haltermann facilities as needed.

Existing specifications for the test fuels are provided in Appendix A. Based on experience to date, SwRI anticipates that the fuel specifications may be altered at the request of EPA. To reiterate from above, such alterations to fuel specifications may result in additional costs and project delays that cannot be anticipated by SwRI and are not accounted for in this Work Plan.

It is expected that the test fuels will be blended exclusively from refinery components and cuts of refinery components, and that special chemicals and chemical blendstocks would not be used. However, butane and benzene may be used to adjust RVP and benzene content of these fuels, respectively. The distillation properties of the test fuels should meet the following requirements:

- The segments of distillation curves between T_{10} and T_{50} should either be straight lines or slightly convex.
- The segments of distillation curves between T_{50} and T_{90} should be concave.
- T_{90} minus T_{80} should not exceed 50°F and for nearly all fuels should be lower than 40°F.

It is expected that sulfur content of the fuels will be adjusted using a three-component sulfur mixture containing 4.3 mass % of dimethyl disulfide, 22.8 mass % of thiophene and 72.9 mass % of benzothiophene. All blendstocks used by Haltermann in this program will be approved by the WAM.

It is understood that all ethanol-containing fuels should be prepared using denatured ethanol meeting the requirements of ASTM D4806 standard. The properties of all ethanol-containing fuels will be reported on a total sample basis (e.g., hydrocarbon type content by ASTM D1319 will be corrected for ethanol content in the fuel). An oxidation inhibitor shall be added to all finished test fuels.

Hand blend inspection data for every test fuel will be presented to the EPA WAM for review. Final blending will not proceed unless authorized by the EPA WAM. Final blend inspection data generated by Haltermann will be forwarded to the EPA WAM for review prior to the shipment of these fuels for use in this test program. The shipment of the fuels to SwRI and their use in this program will not proceed unless authorized by the EPA WAM.

Upon the receipt of test fuels, SwRI will conduct a set of analyses listed in Table 1 on a single drum sample of each fuel. Additional analyses will be conducted on a single drum sample of each fuel at the midpoint and at the end of the program to determine if any fuel properties have changed as a result of fuel storage and handling. In cases where analytical results provided by SwRI and Haltermann do not match, it may be necessary for both parties to repeat some analyses.

It is understood that test fuel should not be stored outside, and should be maintained in sealed 5B drums at a constant temperature of no more than 75°F (nominal). To assure that no fuel drums are mislabeled, SwRI will confirm fuel properties listed in Table 2 using a Petrospec analyzer each time a new drum is opened. Additionally, unique alphanumeric labels assigned to individual drums will be recorded each time a vehicle is fueled.

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TABLE 1. TEST FUEL ANALYSES

FUEL PROPERTY	TEST METHOD
Relative Density	ASTM D4052
Ethanol	ASTM D5599
Total Oxygenates Other Than Ethanol	ASTM D5599
Distillation	ASTM D86
DVPE	ASTM D5191
Aromatics	ASTM D1319
Olefins	ASTM D1319
Benzene	ASTM D3606
Sulfur	ASTM D5453
RON	ASTM D2699
MON	ASTM D2700
Hydrogen	ASTM D4808 Method A
Oxygen	ASTM D5599
Net Heat of Combustion	ASTM D4809 Also report C and H by ASTM D5291

TABLE 2. TEST FUEL PROPERTIES TO BE CONFIRMED USING A PETROSPEC ANALYZER

ETHANOL CONTENT OF THE FUEL, VOL. %	FUEL PROPERTIES TO BE CONFIRMED
0 – 15	Ethanol content, aromatic content, T90
> 15	Aromatic content, T90

A 5-gallon sample of each test fuel for shipment to the EPA, as well as fuel samples needed to perform the analyses listed in Table 1, will be taken from drums cooled below 50°F (preferably placed on their sides). Care will be taken to avoid splashing of the fuels during sampling by making sure that the filling tube reaches to the bottom of each container being filled.

4.0 REPORTING AND DELIVERABLES

4.1 Weekly Reports

SwRI will provide 30-60 minute telephone conference reports weekly that summarize progress to date. It is expected that this teleconference will cover WAs 1-01, 1-02, and 1-04 together.

The oral report will indicate progress achieved in the preceding week, technical issues encountered, solutions to issues (proposed or attempted), and projected activity in the following week. This report will include any potential issues or circumstances that arise causing any delays in the testing.

SwRI will provide on a weekly basis to the WAM a report summarizing hours and dollars expended for individual tasks. The goal of the report is to identify as early as possible if costs in hours and dollars are exceeding that which has been budgeted for the program.

4.2 Monthly Written Progress Reports

SwRI will provide monthly progress reports. Invoices will be provided every four weeks according to the existing contract. The monthly progress reports will include information from the most recent invoice. The reports will track percentages of hours used in each task and whether the project is on schedule. They will explain problems encountered including resolutions and indicate if the schedule or budget is affected.

4.3 Data Files

SwRI will submit fuel information for review to the EPA WAM in a Microsoft Excel format. SwRI also expects to deliver fuel information for Mobile Source Observation Database (MSOD). During the program it may be necessary to design and apply new data types, tables and structures. Such alterations may result in additional costs and project delays that cannot be anticipated by SwRI and are not accounted for in this Work Plan.

4.4 Mode of Delivery

SwRI will deliver one set of files to the EPA WAM at the USEPA National Vehicle and Fuel Emissions Laboratory at Ann Arbor, Michigan. Data contained in the MSOD formatted tables will be submitted via a secure method to be approved by the WAM. Under no circumstances will these files be delivered by insecure methods such as electronic mail attachments or First Class Mail.

4.5 Draft Final Report

SwRI will submit a draft final report to EPA within six weeks following the delivery of all test fuels required under this Work Assignment. The report will detail the work completed including any issues encountered and will include:

- Detailed fuel specifications
- Changes in fuel specification submitted by the EPA WAM
- Quantities of fuels procured
- Graphical displays as needed summarizing the data by fuel type and other relevant breakdowns

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4.6 Final Report

SwRI will provide a final report incorporating EPA comments, within 30 days of receiving comments from EPA. The report will be in hard copy plus an agreed-upon electronic format such as Microsoft Word or Adobe portable document files (*.pdf).

5.0 STAFF ASSIGNMENTS

The SwRI Work Assignment Manager and Principal Investigator will be Kevin Whitney. Mr. Patrick Merritt will be the alternate Work Assignment Manager.

6.0 PROJECTED LABOR HOURS AND OTHER DIRECT COSTS

Based on our understanding of Work Assignment 1-04, we project the breakdown of employee utilization by labor category as detailed in Table 3. Estimates for other direct costs are shown in Table 4. Please note that the fuel cost estimates presented herein are based on the EPA-provided fuel specifications in Appendix A. Complete cost details for this effort are presented in the attached cost breakdown shown in Appendix B. Any changes in the fuel specifications may result in additional costs to the project that cannot be anticipated by SwRI and are not accounted for in the attached cost breakdown.

TABLE 3. PROJECTED LABOR HOURS FOR WORK ASSIGNMENT 1-04

LABOR CATEGORY	NUMBER OF HOURS
PL4	Ex. 4 - CBI
PL3	
PL2	
PL1	
Senior Technical	
Technical	
Clerical	
Total	
Total Technical Hours	

TABLE 4. PROJECTED OTHER DIRECT COSTS FOR WORK ASSIGNMENT 1-04

ITEM	PROJECTED OTHER DIRECT COSTS
Fuel 19: 20-55 gal drums to SwRI	Ex. 4 - CBI
Fuel 19: 4-55 gal drums to EPA	
Fuel 1: 10-55 gal drums to SwRI	
Fuel 2: 10-55 gal drums to SwRI	
Fuel 3: 10-55 gal drums to SwRI	
Fuel 4: 10-55 gal drums to SwRI	
Fuel 5: 10-55 gal drums to SwRI	
Fuel 6: 10-55 gal drums to SwRI	
Fuel 7: 10-55 gal drums to SwRI	
Fuel 8: 10-55 gal drums to SwRI	
Fuel 9: 10-55 gal drums to SwRI	
Fuel 10: 10-55 gal drums to SwRI	
Fuel 11: 10-55 gal drums to SwRI	
Fuel 12: 10-55 gal drums to SwRI	
Fuel 13: 10-55 gal drums to SwRI	
Fuel 14: 10-55 gal drums to SwRI	
Fuel 15: 10-55 gal drums to SwRI	
Fuel 16: 10-55 gal drums to SwRI	
TOTAL	

7.0 SUMMARY

Southwest Research Institute has responded to Work Assignment 1-04. Should any questions of a technical nature arise, please contact Mr. Kevin Whitney at 210-522-5869 or Mr. Patrick Merritt at 210-522-5422. If there are questions regarding cost or contractual issues, please contact Ms. Sherry Twilligear at 210-522-3948. Thank you for this opportunity to be of service.

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APPENDIX A

EPA-PROVIDED FUEL SPECIFICATIONS

Test Fuel Specification

Finalized on Feb. 22, 2008

E0/E10 Fuels

PROPERTY	UNIT	METHOD	BLENDING TOLERANCE	TEST FUELS															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Relative Density, 60/60°F	-	D4052	NA	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
API Gravity, 60°F	°API	D4052	NA	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Ethanol Content	**vol. %**	**D5599**	**E0: < 0.1; E10: ± 0.5; E15: ± 0.5; E20: ±0.5; E85: ±2**	**10**	**0**	**10**	**10**	**0**	**10**	**0**	**0**	**0**	**10**	**10**	**10**	**0**	**0**	**0**	**10**
Total Content of Oxygenates Other than Ethanol	vol. %	D5599	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
T10	°F	D86	-	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158	<158
T50	**°F**	**D86**	**± 4**	**150**	**240**	**220**	**220**	**240**	**190**	**190**	**220**	**190**	**220**	**190**	**150**	**220**	**190**	**190**	**220**
T90	**°F**	**D86**	**± 5**	**300**	**340**	**300**	**340**	**300**	**340**	**300**	**300**	**340**	**340**	**300**	**340**	**340**	**340**	**300**	**300**
FBP	°F	D86	-	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437	<437
DVPE	**psi**	**D5191**	**± 0.15**	**10.0**	**10.0**	**6.65**	**10.0**	**6.65**	**6.65**	**6.65**	**10.0**	**10.0**	**6.65**	**10.0**	**10.0**	**6.65**	**6.65**	**10.0**	**6.65**
Aromatics	**vol. %**	**D1319**	**± 1.5**	**15**	**15**	**15**	**15**	**40**	**15**	**15**	**15**	**40**	**40**	**40**	**40**	**40**	**15**	**40**	**40**
Olefins	vol. %	D1319	± 1.5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Benzene	vol. %	D3606	± 0.15	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
S	mg/kg	D5453	± 5	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
RON	-	D2699	± 2	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93
MON	-	D2700	± 2	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
(R + M)/2	-	Calc.	± 2	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89
C	mass %	Calc.	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
H	mass %	D4808 Method A	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
O	mass %	D5599	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Water Content	mg/kg	E1064	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Net Heat of Combustion	MJ/kg	D4809	-	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Oxidation Stability	minute	D525	-	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240
Copper Strip Corrosion, 3h at 122°F	-	D130	-	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1
Solvent-Washed Gum Content	mg/100 ml	D381	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

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TEST	METHOD	UNITS	FUEL 19	
			MIN	MAX
Distillation - IBP	ASTM D86	°F	Report	
5%	manual	°F	Report	
10%	method	°F	124	134
20%		°F	141	149
30%		°F	151	159
40%		°F	158	166
50%		°F	175	183
60%		°F	235	243
70%		°F	257	265
80%		°F	281	289
90%		°F	310	320
95%		°F	Report	
Distillation - EP		°F		437
Recovery		vol %	Report	
Residue		vol %	Report	
Loss		vol %	Report	
Gravity, 60°F	ASTM D4052	°API	Report	
Specific Gravity	ASTM D4052	-	Report	
Reid Vapor Pressure	ASTM D5191	psi	8.70	9.00
Carbon	ASTM D5291	wt fraction	Report	
Hydrogen	ASTM D5291	wt fraction	Report	
Hydrogen	ASTM D4808-A	wt fraction	Report	
Oxygen	ASTM D5599	wt fraction	Report	
Oxygen, other than ETOH	ASTM D5599	wt fraction		0.15
Ethanol content	ASTM D5599	vol %	14.0	14.0
Sulfur	ASTM D5453	ppm wt	20	30
Lead	ASTM D3237	g/l		0.01
Water content	ASTM D1064	mg/kg	Report	
Composition, aromatics, corrected	ASTM D1319	vol %	18.6	21.6
Composition, olefins, corrected	ASTM D1319	vol %	5.5	8.5
Composition, saturates, corrected	ASTM D1319	vol %	Report	
Benzene	ASTM D3606	vol %	0.47	0.77
Existent gum, washed	ASTM D381	mg/100mls		5.0
Research Octane Number	ASTM D2699		91.0	95.0
Motor Octane Number	ASTM D2700		83.0	87.0
(R+M)/2	D2699/2700		87.0	91.0
Corrosion, Copper, 3h at 122°F	ASTM D130			1
Oxidation stability	ASTM D525	minutes	240	
Net Heat of Combustion	ASTM D4809-A	BTU/lb	Report	

APPENDIX B

COST DETAIL FOR WORK ASSIGNMENT 1-04

Ex. 4 - CBI

Ex. 4 - CBI

Ex. 4 - CBI

Ex. 4 - CBI

Ex. 4 - CBI

Ex. 4 - CBI

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