**COORDINATING RESEARCH COUNCIL, INC.**

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 **June 24, 2020**

In reply, refer to:

 CRC Project No. CM-136-20

Dear Prospective Bidder:

The Coordinating Research Council (CRC) invites you to submit a written proposal to provide services for “Study of Modern Gasoline Oxidation Stability and Correlation Between and Precision Updates for Oxidation Stability Tests ASTM D525/ISO 7536/IP 40 and D7525” (CRC Project No. CM-136-20). A description of the project is presented in Exhibit A, “Statement of Work.”

Please indicate by letter, fax, or email by **July 8, 2020** if you or your organization intends to submit a written proposal for this research program. CRC will answer technical questions regarding the Request for Proposal if they are submitted in writing. CRC will then return written answers to all of the bidders, along with a copy of the original questions.

A CRC technical group composed of industry representatives will evaluate your proposal. CRC reserves the right to accept or reject any or all proposals.

The reporting requirements will be monthly progress reports and a summary technical report at the end of the contractual period. The reporting requirements are described in more detail in the attachment entitled “Reports” (Exhibit B). Contract language for intellectual property and liability clauses is presented in Exhibit C and in Exhibit D, respectively. Important selection factors to be taken into account are listed in Exhibit E. CRC evaluation procedures require the technical group to complete a thorough technical evaluation before considering costs. After developing a recommendation based on technical considerations, the costs are revealed and the recommendation is modified as needed.

**The proposal must be submitted as two separate documents.** The technical approach to the problem will be described in part one, and a cost breakdown that is priced by task will be described in part two. The cost proposal document should include all costs associated with conducting the proposed program. The technical proposal shall not be longer than 10 pages in length (not including resumes). **The schedule / timeline information should be included in the technical proposal.**

CRC expects to negotiate a cost-plus fixed fee or cost reimbursement contract for the research program.

The technical and cost proposals should be submitted to:

**Christopher J. Tennant** Email:**ctennant@crcao.org**

The deadline for receipt of your proposal is **July 24, 2020**

**EXHIBIT A**

**Statement of Work**

**Study of Modern Gasoline Oxidation Stability and Correlation Between and Precision Updates for Oxidation Stability Tests ASTM D525/ISO 7536/IP 40 and D7252.**

**Summary**

There have been many changes to modern gasoline that have likely improved its oxidation stability and thus its ability to remain fit for purpose upon extended storage in a fuel tank or container. However, there is little controlled experimental data on typical modern gasoline storage stability. The last study was by Leo Stavinoha, et. al. in 1990 (ref. 1). This CRC project is aimed at accomplishing three tasks:

1. Provide information on long-term storage ability of modern US and European gasolines in automotive ICE and hybrid engine fuel tanks and storage containers under typical and aggressive ambient conditions.
2. Develop a relationship between observed fuel storage characteristics and accelerated oxidation tests’ results. Attempt to correlate actual storage behavior with accelerated test results.
3. Develop a relationship between ASTM/IP/ISO oxidation tests (D525/IP 40/ISO 7536) Pressurized Cylinder Induction Period test and the ASTM D7525 Rapid Small-Scale Oxidation Test (RSSOT). Develop updated precision statements for all tests. Perform this task with both North American and European fuels to develop a robust correlation useful in multiple jurisdictions. ASTM may assist with the round-robin Interlaboratory Study (ILS) support and the Institute of Petroleum (IP) will contribute as a partner to keep these standards jointed. The intent is to perform the test comparisons and precision and bias in accord with ASTM D6300/ISO 4259 to meet ASTM/IP/ISO requirements for precision determination.

**Background**

With the advent of more plug-hybrid electric vehicles, there is now the real possibility that some vehicles will store gasoline fuel for the supplementary gasoline engine for extended periods (e.g. months) depending upon the driving cycle of the owner. This extended fuel storage raises the question as to how long may gasoline be fit for purpose when called upon to power the spark ignition engine? Adding to the uncertainty of an answer to this question are the significant changes to typical US and European gasoline supplies (e.g. 10 ppm or less sulfur and attending composition changes with desulfurization, addition of ethanol, reduction in benzene levels, higher concentrations of engine-cleaning detergents via Top Tier participation (US), introduction of reformulated gasoline in certain areas, and others).

The objectives for this program are intended to address this question about storage stability for typical modern gasolines. It is extremely desirable to develop and document a robust and reliable correlation between actual storage stability observed and the results obtained from the perennial accelerated oxidation test D525. It is also important to recognize that newer, faster, and more reliable test methods may be available to the industry in the form of D7525. In addition, it is desirable to develop a correlation between the actual storage stability observed and results from accelerated oxidation tests ASTM D7525. Finally, it is also desired to develop a correlation between the two accelerated oxidation standard tests D525/ISO 7536 and D7525. In the course of the work, precision statements will also be developed for the two tests to update and complete their respective standards.

When conceived in 1939, D525 was the state of the art when only when non-oxygenated and sometimes unstable thermally cracked gasolines existed. However, in today’s technological environment where safe, cost effective, and more flexible technologies exist to test oxygenated and non-oxygenated gasolines, the D525 Induction Period accelerated stability test is now a cumbersome test to run with associated safety issues of pressurizing 50 ml. of flammable gasoline with pure oxygen and then immersing in a 100º C heated bath or block heater. The test runs until the “break point” defined by a pressure loss of the oxygen over two defined periods. Current ASTM D4814 spark ignition fuel stability requirements are for a minimum of 240 minutes break period for cargos of gasoline that leave the refinery. But many labs find this test procedure too lengthy, attendant with safety issues involving pressuring a flammable material with oxygen and the inability of some ethanol-blended gasoline to show “sharp” break points meeting the end-point criteria for the test.

Hence there is a strong desire by many fuel test laboratories to move to the ASTM D7525 test that involves smaller quantities of the test fuel and performs the test in a shorter timeframe. D7525 however is not approved for testing the stability requirements for gasoline in the D4814 standard (as well as in EN 228 in Europe). There is a need to develop and correlation between the tests, attempt to relate test results to actual storage fuel deterioration, and develop precision statements for both methods.

**Experimental**

The details of the experiment program need to be defined to provide statistical rigor, but some general direction may be given. The experimental details will be defined with the help of a statistician using design of experiments to yield the most desired information with the least cost and effort. Hence the program could be executed in two stages. The first stage would be to develop statistically designed test programs that would produce predictions for fuel deterioration based on D6300/ISO 4259-1 compliant interlaboratory studies (ILS’s) and a correlation for the two test methods. Initial bidding and contracting of statistical help for the program design and data analysis would be needed. Then the management and execution of the experimental program could be bid out separately. Alternatively, one contractor with statistical design ability could bid out both the statistical experimental planning and the execution of the testing. The choice would be dependent upon the abilities of the contractor.

**Gasolines:**

Finished gasolines (E0, E10, and E15/E20 blended with ethanol or other oxygenates (e.g. in Europe MTBE, ETBE, and TAME are also used) will be procured from several areas of the US and Europe in enough quantities for the tests. In addition, some special less-stable gasolines will be secured and/or made by a contract fuel blender and along with some retail gasolines, stored in nitrogen blanketed 55- gallon drums perhaps in the same location as the vehicle and container storage area. These drums of fuel will be used for the round robin correlation and precision updates of the D525/ISO 7536/IP 40 and D7525 stability tests.

**Storage:**

For the actual vehicle storage stability testing, gasolines will be stored in assembled vehicle fuel systems or actual vehicle fuel tanks. Fuel storage systems/Vehicles should include conventional ICE engine fuel systems as well as sealed hybrid fuel storage systems. Storage conditions will be at ambient and allowed to fluctuate with weather conditions simulating realistic storage. Humidity monitoring of the vapor space in the tanks should be done. Some popular model portable fuel containers will also be used to simulate non-vehicle fuel storage. No inert gas blankets will be used for the in-vehicle or gasoline container storage tests.

**Sampling:**

On a periodic basis, samples of the fuel will be taken from the vehicle tanks and containers for analysis by the contract lab. Unused fuel samples will be returned to the tank from which they were obtained if needed to maintain volumes for future tests.

Samples will also be taken from the stored drums after mixing to ensure homogeneity and then be divided by the contractor for shipment to the participating laboratories. Shipment samples will be purged of oxygen and nitrogen blanketed prior to shipping.

**Analysis:**

Samples will be analyzed for volatility and storage stability properties.

Volatility measurements will include vapor pressure, distillation, Tv/l=20.

Stability properties include: D525/ISO 7536 oxidation stability, D7525 RSSOT, existent and washed gums, peroxides, color, and appearance.

Note the D525/ISO 7536/IP 40 test will be run until the sample breaks or 1440 minutes whichever occurs first.

Test fuels initially will be analyzed for full characterization by the contract and several volunteer laboratories.

**Work Plan:**

Detailed Work plan for the project bidder will include the following:

1. Either from the contractor’s laboratory statistician or a subcontracted statistician, perform design of experiments for:
	1. the extended storage stability test program,
	2. the correlation work between the two accelerated test methods ASTM D525/ISO 7536/IP 40 and D7525, and
	3. the determination of Reproducibility and repeatability for each of the accelerated tests.
2. Based on the test plans, secure enough quantities of the test fuels from a contract fuel supplier and/or CRC participating members or other sources. Poor stability fuels may be hard to find, and these may have to be specially blended by a supplier. Keep these fuels in a condition that prevents degradation (e.g. chilling and/or inerting).
3. CRC will offer the list of volunteers participating laboratories (North America and Europe) to run the round robin samples as designated in the experimental test plan. Involve ASTM Interlaboratory test program assistance to facilitate the test program.
4. Samples from the extended real-time storage testing will be run by the bidding laboratory to measure real-time stability over the test period. Other labs (i.e. volunteer) can be used in addition per the statistical design requirements.
5. Prepare and share monthly progress reports to the project team on progress of the program.
6. At the end of the program, prepare and distribute an acceptable report on the study.
7. “Evaluation of Motor Gasoline Stability”, Interim Report BFLRF No. 266, L.L. Stavinoha, J.N. Bowden, and M.E. LePera; US Army Belvoir Research, Development and Engineering Center, Contract No. DAAK70-87-C-0043, Dec. 1990.

**EXHIBIT B**

**REPORTS**

**MONTHLY TECHNICAL PROGRESS REPORTS**

The contractor shall submit a monthly technical progress report covering work accomplished during each calendar month of the contract performance. An electronic Microsoft® Word compatible file (<1 MB) of the monthly technical progress report shall be distributed by the contractor within ten (10) calendar days after the end of each reporting period. The report shall contain a description of overall progress, plus a separate description for each task or other logical segment of work on which effort was expended during the reporting period. Periodic conference calls may also be requested by CRC to update the technical committee overseeing the project.

**FINAL REPORT**

The contractor shall submit to CRC a draft final report. The report shall document the test procedure, document details of each test iteration, and explain any observations noted. The test data will be recorded and reviewed, and the final report will include a certification that the test procedures were followed, noting any exceptions. The detailed data will also be supplied electronically to CRC.

The draft report must have appropriate editorial review corrections made by the contractor prior to submission to CRC to avoid obvious formatting, grammar, and spelling errors. The report should be written in a formal technical style employing a format that best communicates the work conducted, results observed, and conclusions derived. Standard practice typically calls for a CRC Title Page, Disclaimer Statement, Foreword/Preface, Table of Contents, List of Figures, List of Tables, List of Acronyms and Abbreviations, Executive Summary, Background, Approach (including a full description of all experimental materials and methods), Results, Conclusions, List of References, and Appendices as appropriate for the scope of the study. Incomplete draft reports or reports of poor quality requiring additional outside editorial review may have outside editorial services charged back to the project budget.

Comments regarding the report shall be furnished by the CRC committee to the contractor within one (1) month after receipt of the draft copy. Additional rounds of review may be required.

Within thirty (30) days after receipt of comments, the contractor shall make the requested changes and submit an electronic copy of the draft final report in both Microsoft Word and Adobe pdf file format. Once accepted, the contractor shall deliver five (5) hard copies of the final report to CRC. The final report may be prepared using the contractor’s standard format, acknowledging author and sponsors. An outside CRC cover page will be provided by CRC. The electronic copy will be made available for posting on the CRC website.

**EXHIBIT C**

**INTELLECTUAL PROPERTY RIGHTS**

Title to all inventions, improvements, and data, hereinafter, collectively referred to as (“Inventions”), whether or not patentable, resulting from the performance of work under this Agreement shall be assigned to CRC. Contractor X shall promptly disclose to CRC any Invention which is made or conceived by Contractor X, its employees, agents, or representatives, either alone or jointly with others, during the term of this agreement, which result from the performance of work under this agreement, or are a result of confidential information provided to Contractor X by CRC or its Participants. Contractor X agrees to assign to CRC the entire right, title, and interest in and to any and all such Inventions, and to execute and cause its employees or representatives to execute such documents as may be required to file applications and to obtain patents covering such Inventions in CRC’s name or in the name of CRC’s Participants or nominees. At CRC’s expense, Contractor X shall provide reasonable assistance to CRC or its designee in obtaining patents on such Inventions.

To the extent that a CRC member makes available any of its intellectual property (including but not limited to patents, patent applications, copyrighted material, trade secrets, or trademarks) to Contractor X, Contractor X shall have only a limited license to such intellectual property for the sole purpose of performing work pursuant to this Agreement and shall have no other right or license, express or implied, or by estoppel. To the extent a CRC member contributes materials, tangible items, or information for use in the project, Contractor X acknowledges that it obtains only the right to use the materials, items, or information supplied for the purposes of performing the work provided for in this Agreement, and obtains no rights to copy, distribute, disclose, make, use, sell or offer to sell such materials or items outside of the performance of this Agreement.

# EXHIBIT D

# LIABILITY

# It is agreed and understood that \_\_\_\_\_\_\_\_\_\_\_\_ is acting as an independent contractor in the performance of any and all work hereunder and, as such, has control over the performance of such work. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ agrees to indemnify and defend CRC from and against any and all liabilities, claims, and expenses incident thereto (including, for example, reasonable attorneys’ fees) which CRC may hereafter incur, become responsible for or pay out as a result of death or bodily injury to any person or destruction or damage to any property, caused, in whole or in part, by \_\_\_\_\_\_\_\_\_’s performance of, or failure to perform, the work hereunder or any other act of omission in connection therewith.

# EXHIBIT E

**PROPOSAL EVALUATION CRITERIA**

1) Merits of proposed technical approach.

2) Previous performance on related research studies.

1. Personnel available for proposed study – related experience.
2. Timeliness of study completion.
3. Cost.