



COORDINATING RESEARCH COUNCIL, INC.

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April 25, 2024

In reply, refer to:

CRC Project No. E-141

Dear Prospective Bidder:

The Coordinating Research Council (CRC) invites you to submit a quotation to provide services for “Fuel Procurement Post Tier 3 Vehicle and Fuels Evaluation” (CRC Project No. E-141). A description of the project is presented in Exhibit A, “Statement of Work.” Your quotation should include a technical description of the measurement methodologies for PMI, including the PMI determination methodology, the component list in the GC database, and how generic and unknown compounds are handled.

Please indicate your intention to bid at [this link](#) on or before **May 13, 2024** 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 at least one week before the quotation submission deadline here: [Q & A Link](#). CRC will then return written answers to all of the bidders, along with a copy of the original questions. Questions submitted within a week of the deadline may not be answered before the quotations submission deadline.

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

Electronic copies of the quotations should be submitted to:

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The deadline for receipt of your proposal is **May 31, 2024**

Yours truly,
Amber B. Leland
Deputy Director

Form Links:

Intention to Bid: <https://form.asana.com/?k=ldnxN4m7VYymCW2k-LXdZA&d=1109089988204036>

Question and Answers: <https://form.asana.com/?k=SkZ4dzE7oKIGgmnLhnTJ5Q&d=1109089988204036>

EXHIBIT A

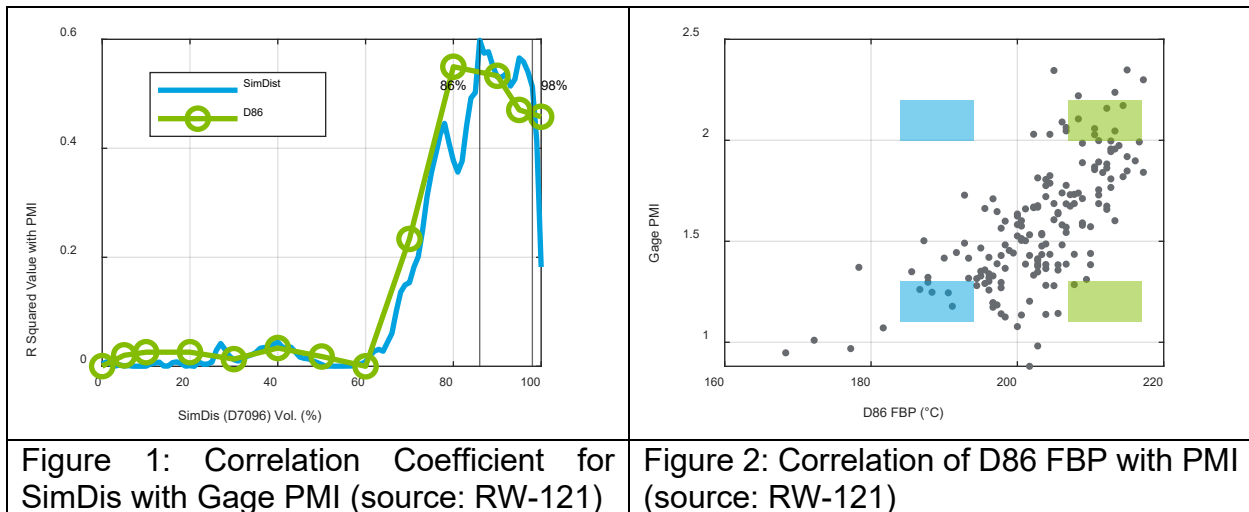
CRC Project Statement of Work “Fuel Procurement for Post Tier 3 Vehicle and Fuels Evaluation”

CRC Project Number: E-141

BACKGROUND

Gasoline fuels with specific properties are required for CRC as part of a vehicle testing program. The fuels are designed and specified to deconvolute and independently assess the effects of distillation and PMI on vehicle tailpipe emissions compared with a baseline fuel.

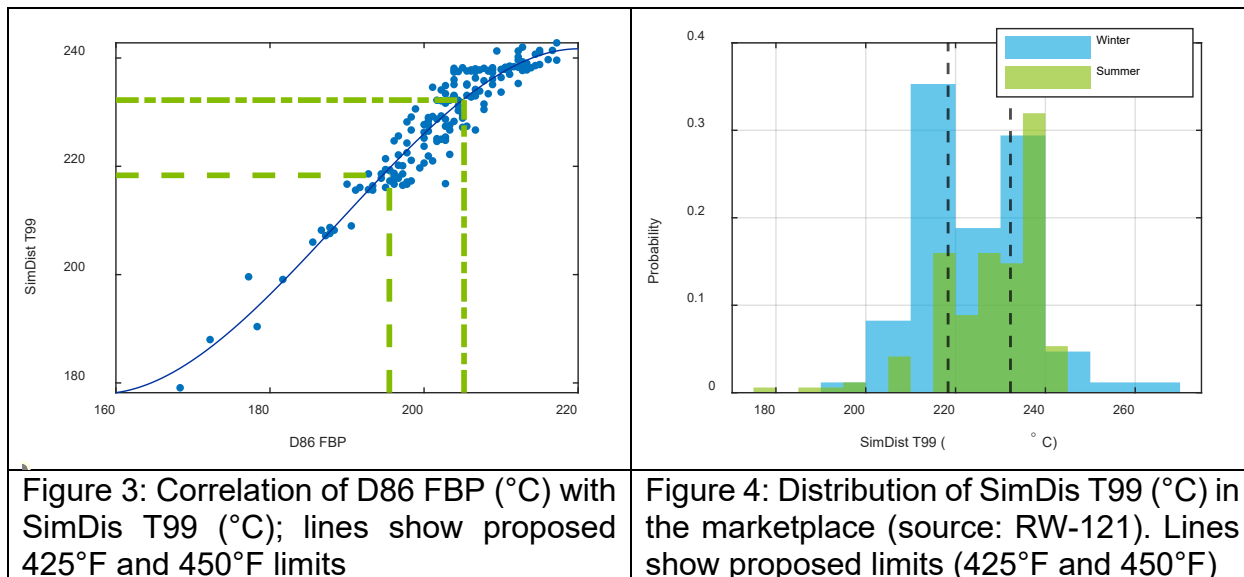
Gasoline PMI is weakly correlated with distillation, considering both D86 and D7096 SimDis (Figure 1). Back-end distillation parameters such as T80 and T90 are most correlated with PMI, however the correlation is nonetheless weak ($R^2 \sim 0.5$). Although PMI and D86 distillation are not intrinsically correlated, the PMI of test fuels in previous studies have sometimes been, coincidentally, highly collinear (R^2 of ~ 0.95 , much greater than the general correlation of these properties in the market). This work aims to break that collinearity in order to study the effects of PMI and distillation independently, by formulating fuels which represent the extremes of PMI and distillation in the market (Figure 2).



In addition, back-end distillation has come under scrutiny as a possible predictor of PMI. For example, a limit of either 425°F or 450°F (218°C or 232°C) have been discussed for SimDis T99 cutoff in recent regulatory rulemaking proposals. Therefore, there is interest in deconvoluting back-end distillation (FBP) from overall distillation, as well as from PMI, and determining if any are independently and universally correlated with vehicle tailpipe emissions.

Although SimDis end point is not correlated with D86 final boiling point, SimDis T99 is correlated with final boiling point (Figure 3). Thus, SimDis T99 can be estimated from

FBP. SimDis T99 is also not correlated with other distillation parameters, such as T10, T50, T90 and DVPE – allowing these properties to be independently varied.



A summary of the proposed SimDis limits are shown in Table 1. The lower limit, if enacted, would affect around 80% of summer gasolines and more than half of winter gasolines. The less aggressive 450°F end point limit would affect half of summer gasolines and around a third of winter gasolines.

Table 1. Summary of Proposed SimDis ASTM D7096 Limits

	Proposed limit (°F)	Proposed limit (°C)	Estimated FBP (°C)	Percentile (summer)	Percentile (winter)
Lower Proposed Limit	425	218	~195	18	41
Higher Proposed Limit	450	232	~205	54	72

SCOPE

Contractor shall blend, formulate, test, and deliver 4 drums of various fuels for vehicle testing. In addition, 4 gallons of each fuel should be allocated for testing at member labs. The fuels include certification gasolines to check data quality, as well as two baseline fuels representative of typical market gasolines--used for assessing the impact of various changes in fuel properties due to market variation.

The other test fuels include two higher volatility, winter gasolines representative of the 90th percentile of DVPE and D86 distillation in the market, and four lower volatility, summer gasolines representative of the 10th percentile of DVPE and D86 distillation in the market. Of the two summer gasolines, two shall be formulated with a lower endpoint

(around 195°C D86 FBP and around 425°F SimDis T99), in line with the EPA’s recent rulemaking proposal—while keeping all other distillation points the same as the other two summer volatility gasolines. The Baseline and Cold Baseline fuels both have endpoints which are similar to the higher 450°F proposed limit.

Each fuel set shall include a high and low PMI variant, also representative of the 10th and 90th percentile of PMI in the market. Fuel property limits for each of the test fuels have been selected based on the results of the RW-121 Fuel Survey.

Reference Link to PME Calculator - <https://crao.org/crc-repository-for-projects-and-literature-related-to-dha-methodologies-and-pmi-calculations/>

Table 2 – Summary of Test Fuels

	Fuel Name	Description	DVPE (PSI)	D86 FBP (°C)	SimDis T99	PMI
<u>1</u>	<u>Cert Fuel</u>	<u>Tier 3 certification gasoline</u>	<u>8.7-9.2</u>	<u>193-216</u>	<u>Report (~216-241)</u>	<u>Report</u>
<u>2</u>	<u>Cold Cert Fuel</u>	<u>Tier 3 certification gasoline – cold test</u>	<u>11.2-11.8</u>	<u>193-216</u>	<u>Report (~216-241)</u>	<u>Report</u>
<u>3</u>	<u>Baseline Fuel</u>	<u>Median market gasoline</u>	<u>10.5-11.5</u>	<u>196-206</u>	<u>Report (~220-233)</u>	<u>1.5-1.6</u>
<u>4</u>	<u>Cold Baseline Fuel</u>	<u>Median winter gasoline</u>	<u>13.5-14.5</u>	<u>193-203</u>	<u>Report (~216-230)</u>	<u>1.5-1.6</u>
<u>5</u>	<u>Fuel A</u>	<u>High volatility, low PMI</u>	<u>14-15</u>	<u>184-194</u>	<u>Report (~202-217)</u>	<u>1.1-1.3</u>
<u>6</u>	<u>Fuel B</u>	<u>High volatility, high PMI</u>	<u>14-15</u>	<u>184-194</u>	<u>Report (~202-217)</u>	<u>2.0-2.2</u>
<u>7</u>	<u>Fuel C</u>	<u>Low volatility, low PMI</u>	<u>7-8</u>	<u>207-217</u>	<u>Report (~234-241)</u>	<u>1.1-1.3</u>
<u>8</u>	<u>Fuel D</u>	<u>Low volatility, high PMI</u>	<u>7-8</u>	<u>207-217</u>	<u>Report (~234-241)</u>	<u>2.0-2.2</u>
<u>9</u>	<u>Fuel E</u>	<u>Low volatility, low FBP, low PMI</u>	<u>7-8</u>	<u>Report (~<195)</u>	<u><218</u>	<u>1.1-1.3</u>
<u>10</u>	<u>Fuel F</u>	<u>Low volatility, low FBP, high PMI</u>	<u>7-8</u>	<u>Report (~<195)</u>	<u><218</u>	<u>2.0-2.2</u>

All formulated fuels shall comply with the following requirements:

- Meet all property limits specified in table below.
- Top tier detergent treat rate
- Addition of anti-oxidant
- No single component >20% volume
- Compliance with D4814
- Certification fuels shall meet all requirements of 40 CFR 1065

Since the fuel quantity may change, cost should be provided on a per drum basis, with separate charge for formulation and analysis of fuel.

Fuel Properties to Report (excel spreadsheet also available):

	Fuel Number -->	1	2	3	4	5	6	7	8	9	10
Specification	Test Method	Cert Fuel	Cold Cert Fuel	Baseline Fuel	Cold Baseline	Fuel A	Fuel B	Fuel C	Fuel D	Fuel E	Fuel F
RON	ASTM D2699	Report	Report	91-93	91-93	91-93	91-93	91-93	91-93	91-93	91-93
MON	ASTM D2700	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Octane sensitivity	calc	>7.5	>7.5	Report	Report	Report	Report	Report	Report	Report	Report
AKI	calc	87-88.4	87-88.4	87-89	87-89	87-89	87-89	87-89	87-89	87-89	87-89
Ethanol (vol. %)	ASTM D4815	9.4-10.2	9.4-10.2	9.5-10	9.5-10	9.5-10	9.5-10	9.5-10	9.5-10	9.5-10	9.5-10
DVPE (kPa)	ASTM D5191	8.7-9.2	11.2-11.8	10.5-11.5	13.5-14.5	14.5-15	14.5-15	7-8	7-8	7-8	7-8
IBP (°C)	ASTM D86	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
T10 (°C)	ASTM D86	49-60	43-54	43-53	36-46	32-42	32-42	53-63	53-63	53-63	53-63
T50 (°C)	ASTM D86	88-99	88-99	76-86	63-73	61-71	61-71	97-107	97-107	97-107	97-107
T90 (°C)	ASTM D86	157-168	157-168	150-160	148-158	141-151	141-151	159-169	159-169	159-169	159-169
FBP	ASTM D86	193-216	193-216	196-206	193-203	184-194	184-194	207-217	207-217	~195	~195
SimDis	ASTM D7096 Enhanced (*)	Report	Report	Report	Report	Report	Report	Report	Report	<218	<218
SimDis - @1% incr.	ASTM D7096 Enhanced (*)	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Calculated distillation from DHA @ 1% incr.	ASTM D6730 Appendix X1	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Temperature of V/L = 20	ASTM D5188	Report	Report	>35	>35	>35	>35	>35	>35	>35	>35
Residue (%)	ASTM D86	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Aromatics (vol. %)	ASTM D5769	21-25	21-25	15-25	15-25	15-25	15-25	15-25	15-25	15-25	15-25
C7 Aromatics (vol. %)	ASTM D5769	5.2-6.4	5.2-6.4	0-15	0-15	0-15	0-15	0-15	0-15	0-15	0-15
C8 Aromatics (vol. %)	ASTM D5769	5.2-6.4	5.2-6.4	0-20	0-20	0-20	0-20	0-20	0-20	0-20	0-20
C9 Aromatics (vol. %)	ASTM D5769	5.2-6.4	5.2-6.4	4-7	4-7	2-7	4-10	2-7	4-10	2-7	4-10
C10 Aromatics (vol. %)	ASTM D6730	Report	Report	2-3.5	2-3.5	1-3	2-5	1-3	2-5	1-3	2-5
C11 Aromatics (vol. %)	ASTM D6730	Report	Report	0.5-1	0.5-1	0-0.75	0-1.5	0-0.75	0-1.5	0-0.75	0-1.5
C12 Aromatics (vol. %)	ASTM D6730	Report	Report	0-1	0-1	0-1	0-2	0-1	0-2	0-1	0-2
C13+ Aromatics (vol. %)	ASTM D6730	Report	Report	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C10+ Aromatics (vol. %)	ASTM D5769	4.4-5.6	4.4-5.6	Report	Report	Report	Report	Report	Report	Report	Report
Polyaromatics (vol. %)	ASTM D6730	Report	Report	0-1.5	0-1.5	0-1	0.5-2	0-1	0.5-2	0-1	0.5-2
Diolefins (vol. %)	ASTM D6730	Report	Report	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Olefins (vol. %)	ASTM D6730	Report	Report	2-12	2-12	2-12	2-12	2-12	2-12	2-12	2-12
Olefins (vol. %)	ASTM D6550	4-10	4-10	Report	Report	Report	Report	Report	Report	Report	Report
Naphthenes (vol. %)	ASTM D6730	Report	Report	4-11	4-11	4-11	4-11	4-11	4-11	4-11	4-11
Paraffins (vol. %)	ASTM D6730	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Total other oxygenates (vol. %)	ASTM D4815	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Particulate Matter Index by Contractor	ASTM D6730 Appendix X1	Report	Report	1.5-1.6	1.5-1.6	1.1-1.3	2.0-2.2	1.1-1.3	2.0-2.2	1.1-1.3	2.0-2.2
Particulate Matter Index by SSI	ASTM D6730 Appendix X1	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Sulfur (ppm)	ASTM D5453	8 - 11	8 - 11	8-10	8-10	8-10	8-10	8-10	8-10	8-10	8-10
Benzene (wt. %)	ASTM D5769	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62
Lead content (g/L)	ASTM D3237	0.0026	0.0026	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Manganese content (g/L)	ASTM D3831	Report	Report	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Phosphorous content (g/L)	ASTM D3231	0.0013	0.0013	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Washed gums (mg/100mL)	ASTM D381	3	3	<1	<1	<1	<1	<1	<1	<1	<1
Oxidation stability (min)	ASTM D525	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000
Silver corrosion	ASTM D7671	Report	Report	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Copper corrosion	ASTM D130	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Density (g/mL)	ASTM D4052	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Lower heating value (MJ/kg)	ASTM D240	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Carbon, hydrogen and oxygen (wt. %)	ASTM D5291	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Detailed hydrocarbon composition	ASTM D6730	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
	EPA SW846-6020	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Metals by ICP-MS	or similar	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
Particulate contamination	ASTM D7619	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
PME	per NREL	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report
YSI	per NREL	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report

(*) = Contact CRC for method

