

**Questions and Answers Regarding CRC Project Number CM-136-09-1
Engine Durability Study of Intermediate Ethanol Blends**

#	Question	Answer / Comment
1	In the "Vehicles" section of the request for quote, the number of vehicles to be purchased is set at 14, later it is set at 56. Which number is correct? Please confirm the total number of vehicles to be tested.	14 vehicle types, 4 copies of each, product is 56 vehicles
2	What gear is it anticipated to run the test schedule in? This affects mileage which directly affects the oil change interval.	Given that most or all of these vehicles will have automatic transmissions the gear state will depend on the transmission calibration. We should define the oil change interval by number of engine revolutions.
3	Octane requirement for E0 fuel? Will have an affect on EGT.	Fuel should match the recommended fuel for each vehicle, typically RUL.
4	Can the engines be run on engine dynamometer if deemed to be more cost effective?	Whole vehicle is preferred but it can be quote d both ways.
5	The test cycle contains a point at 2500rpm, 100MAP. Most automatic vehicles which will kickdown. Is it necessary to inhibit kickdown or is the highest load prior to kickdown acceptable?	All transmissions will hold 2500 rpm, 100MAP in first gear.
6	Is Emissions testing FTP only or should the supplementary cycles be considered?	FTP75 and US06
7	<ul style="list-style-type: none"> • What is defined as failure that is observed on (E20/E15/E10) vehicles that is not observed on E0? <ul style="list-style-type: none"> o Catastrophic engine failure only? o Lost of engine power? o Engine controller DFC (diagnostic fault codes)? o Audible noise? o Any statistical analysis required on testing results? o One or both vehicles need to exhibit failure in fuel type test pair? o Repeatable engine sensor failure? o Engine only or other power train systems involve in failure mode? Example: fuel pump? 	<ul style="list-style-type: none"> o Catastrophic engine failure, yes o Lost of engine power, yes o Engine controller DFC (diagnostic fault codes), if root caused to an engine failure, for example misfire traced to valve seat recession; fuel trim to injector failure; catalyst performance o Audible noise, yes, if traced to engine issues like bore wear or valve seat wear o Any statistical analysis required on testing results, yes, comparison of E0 and E20 vehicles for emissions changes or mechanical measurements o One or both vehicles need to exhibit failure in fuel type test pair, one o Repeatable engine sensor failure, yes o Engine only or other power train systems involve in failure mode? Example: fuel pump?, fuel pump, level sender, etc are important components to document. A failure here would be repaired and the test continued. The failed component would be returned to the OEM/Supplier for root cause evaluation.
8	<ul style="list-style-type: none"> • What are the technical guidelines to be followed in an additional vehicle pair to be tested on E15/E10 following a E20 failure? <ul style="list-style-type: none"> o Exact (within what guidelines) vehicle pair duplicates regarding model year and mileage? o Exact (within what guidelines) vehicle pair duplicates regarding engine measurements? 	Model year and mileage
9	<ul style="list-style-type: none"> • What is defined as economical valve seat materials? <ul style="list-style-type: none"> o Iron-based sintered and high nickel alloy seat? o Powered metal steel seat? o Beryllium copper seats? o Induction hardened - nodular/ductile iron alloys seat? o Stainless steel high nickel-chrome alloy seat? o High chrome molybdenum cast iron alloy 	Economical valve seats typically consist of sintered iron, carbon, copper and lubricant wth other ingredients summing to less than 4%.
10	<ul style="list-style-type: none"> • Why the elaborate cooling mechanism? <ul style="list-style-type: none"> o Would blowing air at front of the vehicle, which simulates "real-world driving", be sufficient? o Maintaining coolant at 90°C is ambitious and would require a close loop PID algorithm controlled heat exchanger. Depending on the vehicle, maintaining a supply coolant at 90°C will be difficult at peak power for the periods of time suggested, particularly simulating a pickup at 80% of GVW with towing. If shown to be necessary, using "good engineering judgment", would there be a deviation allowed in suspending the 90°C controlled specification during these peak power periods of the test cycle? o What data must be submitted to support a "good engineering judgment" decisions? 	The elaborate cooling system was suggested to ensure that the vehicle can maintain correct engine temperatures (we don't want this to be a cooling capability test). The test cycle was revised in part to reduce heat load and potentially enable the use of the in vehicle system. Deviations are allowable but we do not want excursions well above 100C.
11	<ul style="list-style-type: none"> o Is it assumed the vehicle is bought up to operating temperature prior to beginning the test cycle? o What is the allowable engine off soak time period between each test cycle? 	It is anticipated that the vehicle will run a large number of test cycles consecutively with no intervening cold soak. After a cold shutdown the vehicles should be brought up to operating temperature with moderate cycling or extended idling as convenient.
12	Does the test consider the negative effects of starting engine and immediately going to wide open throttle (WOT) to peak power without an idle period to achieve engine oil pressure rise and stabilization?	You have a good point and it is addressed above.
13	What sampling frequency is required for recording of engine data fromECM and supplementary sensors if used	No more than 1 hertz
14	For emisisions control, we want to confirm that only catalyst inlet temperature data are required and that no emissions measurements are needed.	No emission measurements are required during the aging cycle
15	The base fuel is shown as E0, do you require that the fuel actually have no oxygenate (like Indolene) or would a commercial fuel with 6-10% Ethanol be acceptable? <u>This will have a significant impact on cost.</u>	The base fuel must have no oxygen, indolene is not required but a controlled, repeatable fuel with no oxygen and correct octane is required.
16	What is the uncertainty acceptable in the fuel blend ethanol percentage? 0.5%, 0.1% ?	+/- 0.25%
17	How often does the fuel require analysis? Each batch or some other interval?	By batch
18	How similar do the 4 vehicles in each category have to be? Exact same model, MY, test group or would vehicles with carry-over/carry-across certifications be acceptable? How close do the odometers have to be?	Same model, engine, transmission, MY, test group, final drive, calibration (can be updated at dealer), optioning can be different. Target mileage is 8,000-12,000 times vehicle age in years.
19	Does CRC have a preference as to how the 500 hour durability testing is performed, with tow dynamometers or on chassis dynamometers? Should the chassis dynamometers be placed indoors in a controlled environment or outside with the test vehicles exposed to the weather?	Testing can be performed using either chassis or tow dynamometers. Testing can be performed indoors or outdoors. Keep in mind that tow dynamometer testing will make the use of an external heat exchanger difficult. One of the reasons for the revised test cycle below is to reduce the heat load on the cooling system making tow dynamometer use more practical. Nonetheless adequate cooling must be maintained.
20	Please provide more detail on the test cycle. Is the entire cycle performed at 70 miles per hour?	Please see the attached revised test cycle (Figure 1). Vehicle speed will be dictated by transmission and final drive ratios and by the transmissions calibration. Higher speeds are preferred for cooling.

21	1. Please confirm that continuous operation is allowable for the 500 hour endurance test or does CRC prefer a certain amount of extended key off soak time?	Continuous operation is allowed as is key-off soak time at the convenience of the test laboratory.
22	Will the vehicles/engines for the fleet to be tested be selected entirely by CRC? Will the chosen contractor act in a support role for selection, or will the vehicles/engines already be chosen prior to the project start?	Vehicles will be chosen by CRC and any cosponsor.
23	Only to verify, all vehicle/parts procurement will be performed by the selected contractor, correct?	Yes
24	For vehicle selection, in the RFP it states that "the auto industry will propose 7 non-FFV vehicle types for the test fleet based on the following guidelines". Following this 6 bullet points are listed, is there a 7th guideline for selection that would correspond to a 7 th vehicle?	We will not have one vehicle corresponding to each bullet. Most vehicles will correspond to several bullets.
25	Is there a certain mix of vehicles that is desired for the fleet? Some passenger cars and some LD trucks? I4's, V6's, and V8's? Domestic and imports?	Yes, Yes, Yes
26	Will the vehicles need to be from certain states, based on different ethanol fueling regulations?	No
27	Based on the RFP, it is our understanding that the 14 vehicles/engines selected will all be run through the 500 hour durability test using E20, and then another 14 vehicles/engines of the same make will be run through the durability test using E0 (for a baseline). If any of the vehicles/engines occur failures during the test using E20, then the same make vehicle will be run through the durability test using E15. If failures occur again the test will be run with E10. Thus, 28 durability tests will be run initially (14 on E20 and 14 on E0) with the possibility of up to 28 more tests. Is this a correct understanding?	The plan is to run replicates so 14 vehicle types times 2 copies times 2 fuels (E0 & E20) = 56 vehicles if there are no failures.
28	Based on the previous bullet points understanding, is it CRC's preference that all 14 vehicles/engines are run using the E20 first, followed by all necessary tests with E15, and then E10? Or is it preferred that as soon as the first vehicle/engine using E20 were to fail that E15 testing be performed immediately for that application?	E0 and E20 runs will be done first followed by E15 etc if necessary.
29	Does CRC have a preferred provider for oil analysis?	We would like to know who the proposed laboratory is prior to the start of testing
30	Does CRC plan to supply the fuel? If not, does CRC have a preferred fuel supplier(s)?	CRC does not propose to supply the fuel
31	It is our understanding and suggestion that each and every engine would be torn down, even those that do not experience issues during durability testing. Is this correct, or does CRC desire that only the engines which experience issues be torn down?	We do not propose tearing down any engines that do not fail. The required measurements are Compression and compression leakdown check, Valve clearances or valve stem location relative to datum (tip heights), FTP75 and US06 emissions and fuel economy and root causing diagnostic trouble codes (DTC). The DTC root cause is the only analysis that could drive teardown activity.
32	For our benchmarking programs, we regularly run FTP75, US06, SC03, and HWFET cycles recording both emission and fuel consumption numbers. Per the RFP, under "Test Procedure", what would CRC like to have included as a baseline per the bullet point "FTP emissions and fuel economy"? Are only the emission and fuel consumption numbers across the FTP75 desired?	FTP75 and US06

Figure 1

