

## Rebuttal of Critiques of the CRC Mid-Level Ethanol Blends Engine Durability Study

### Background

- DOE in its critique, rather conveniently neglects to mention that, through the National Renewable Energy Laboratory (NREL), (a DOE contractor,) it was an active participant in the technical oversight panel for the CRC engine durability study throughout the duration of the program. At no point did NREL object to the tests, test cycles or the test procedures.
- DOE seems to think that it has more expertise than the car designers and manufacturers who designed and conducted the CRC tests. CRC has been doing work of this kind for over 70 years, often with DOE's funding. It is interesting that DOE now feels the need to critique this particular study.
- There is ample evidence that in the end, DOE's and EPA's testing and timing was driven more by the political time clock rather than a desire for a comprehensive test program:
  - Initially, in a June 2008 presentation, EPA outlined for industry the testing it anticipated would be needed for a waiver to be approved. EPA's requirements at the time were consistent with the auto and oil industry's comprehensive test plans. EPA did not follow through on its own recommended broader suite of testing, but instead relied almost entirely on DOE's catalyst durability test project. EPA has not offered an explanation for the change.
  - DOE initially contemplated co-funding this CRC study, but then changed their funding plans and decided to instead fund a tear down of the engines used in their catalyst program knowing full well their approach would not reveal anything because the study tested the catalyst, not the engine. This allowed EPA to do some hand waving at the end of the catalyst test and to say they also looked at engine durability and materials compatibility.
  - DOE made the political decision to inspect "critical engine parts" more than a year after the catalyst testing had already started. EPA and DOE realized that they were missing critical engine durability and materials compatibility data needed to approve a waiver, so instead of running meaningful tests to evaluate these parameters, they piggy-backed onto the catalyst study which was almost near completion. This is the complete opposite of the CRC project where automotive engineers designed the study with detailed and scientifically sound methodologies and plans from start to finish.
  - The driver in all of this was EPA's desire to make an October 2010 approval announcement. DOE's withdrawal of funding for CRC had nothing to do with test cycles and engine selection for the CRC project and everything to do about getting to the finish line before October 2010.
  - Coincidentally, mid-term elections were held November 2, 2010.
- Also, DOE looked for ways to accelerate the catalyst study since testing on one of the vehicles had been delayed. DOE changed the way the test was being run to accumulate miles more quickly so that the delayed vehicle could catch up with the rest. Auto and oil industry representatives strongly disagreed with this approach since this in effect made this one vehicle's test different from the other 18 vehicles.

Rebuttal of specific critiques:

### E0 Testing

It was unnecessary to test more than three engines on E0. The auto and oil industries do not believe in wasting resources on unnecessary tests. The fact that the test cycle was able to pass or fail the seven other engine models means we had a good test tool. The engineers who designed the engine that failed on all three fuels explained what happened during this testing – mainly that for this particular engine the test cycle did not cause the valves to rotate which resulted in abnormal wear for all three fuels. Even so, the E0 failure was less severe than E20 or E15.

### E10 Testing

DOE complained that there was no E10 testing. This allegation is akin to “the pot calling the kettle black.” Curiously, DOE fails to mention that, in its own evaluations of mid-level blends on marine engines, light-duty vehicle evaporative emissions testing, and teardown analyses of engines used in catalyst durability testing, E10 was not used as a control. These tests compared E0 with either E15 or E20. In its catalyst durability testing of Tier 2 vehicles DOE tested 19 vehicles on E0 and E15 but only 5 on E10. DOE chose to not tear down any of the vehicles tested on E10. In support of its initial E15 waiver decision, EPA prepared a Technical Memorandum which analyzed the DOE data and stated that “...since the waiver request is for E15, this analysis focuses on those vehicles that were aged on E15 compared to those vehicles that were aged on E0.” DOE’s testing in support of EPA’s waiver of NLEV and Tier 1 emissions vehicles included not one E10 test. The fuels selected and tested in the CRC engine durability program are fully aligned with both the DOE and EPA work referenced above. The use of E0 and E15 in the CRC study avoids ambiguity as to the source of any effects that may be observed.

### Engine Durability Test Cycles

Engine durability tests by definition stress the engine, unlike DOE’s catalyst test – which stressed the catalyst and nothing else. We all know that when doctors test the durability of the human engine (i.e., our hearts), they put us on a treadmill and keep cranking it up. They and their patients are not just satisfied with a leisurely walk in the park type-test. The test cycle employed by CRC is a standard engine durability test cycle that has been in use for many years. The only modification made to it for this study was to limit the maximum engine speed to 3500 RPM. This modification was made to reduce the test severity, making it more likely that engines would complete the test without experiencing failures unrelated to the test objective, i.e., evaluating the effect of E15 on engine durability. Consumers should trust automotive engineers on this topic more than government regulators. EPA is the expert on devising regulations -- that is what they do. The automakers develop and build engines and emissions control systems -- that is what they do. We have great confidence in our scientific experts who design engines, emissions control systems and fuels.

### Engine Pass/Failure Determination

The engine pass/fail determination was made after engine teardown and analysis. The 10 percent cylinder leakage criterion was used to determine whether there was engine distress

and was used as a signal that teardown was required. The use of a 10% leakdown criterion is far from arbitrary. It is an accepted and standard industry practice/criterion for determining engine distress. Engines that exceeded the 10% leak down criterion in the CRC study were further examined by teardown. The failure was determined by inspection during engine teardown, this evaluation method has been used in the automotive industry for over 100 years.

The investigators in the CRC study evaluated the performance of several different compression and leakdown gauges and ultimately used one tool which provided extremely repeatable measurements (within +/- 1%) – much smaller than the range reported in the DOE program. In addition, the fact that DOE concluded that engine leakdown is “not a reliable indicator of vehicle performance” is not surprising given that the test cycle on which they base their allegation is itself not a reliable measure of changes in engine durability. In contrast to the driving cycle evaluated in the DOE study, the test cycle used by CRC produced dramatic and easily measurable changes so it provided an excellent basis for assessing engine durability.

#### Test Engine Selection

The real point to be made here is that all of the engines tested by CRC are engines that were waived by EPA and are expected by the general public not to have issues with the new fuel, E15. It is true that a couple of the engines tested by CRC were subject to recalls by the National Highway Traffic Safety Administration (NHTSA). However, none of these recalls were for engine-related issues associated with operation on E0 and E10. It also is worth noting that 25 of the 27 vehicle models which DOE had used in its catalyst durability test program were subject to a NHTSA recall of some kind.

#### Aggressive Ethanol

Some who are not experts at fuels or vehicles have claimed that CRC used “aggressive ethanol” or “illegal fuels” in this study. That assertion is blatantly false. The ethanol used in this test program was not an “aggressive ethanol”. It exceeded ASTM specifications, was made by an RFA member, and was representative of what can be found in the market place.

#### Usefulness of the CRC Study

The CRC study is the only real engine durability of its kind. The 240 million drivers of vehicles in the US need DOE, EPA and other government agencies to take responsible actions when it comes to regulating their fuels and vehicles.