HITTING THE ETHANOL BLEND WALL: EXAMINING THE SCIENCE ON E15

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

THURSDAY, JULY 7, 2011

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Thursday, July 7, 2011

Appendix II: Additional Material for the Record

HITTING THE ETHANOL BLEND WALL: EXAMINING THE SCIENCE ON E15

THURSDAY, JULY 7, 2011

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 2:55 p.m., in Room 2318 of the Rayburn House Office Building, Hon. Andy Harris [Chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

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Subcommittee on Energy & Environment

Hitting the Ethanol Blend Wall: Examining the Science on E15

Thursday, July 7, 2011
2:00 p.m. to 4:00 p.m.
2318 Rayburn House Office Building

Witnesses

Ms. Margo Oge, Director, Office of Transportation and Air Quality,

U.S. Environmental Protection Agency

Mr. Bob Greco, Group Director of Downstream and Industry Operations, American Petroleum Institute

Ms. Heather White, Chief of Staff and General Counsel, Environmental Working Group

Mr. Jeff Wasil, Emissions Certification Engineer, Evinrude Outboard Motors

Mr. Mike Brown, President, National Chicken Council

Mr. W. Steven Burke, President and CEO, Biofuels Center of North Carolina

Dr. Ron Sahu, Independent Technical Consultant

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY & ENVIRONMENT

HEARING CHARTER

Hitting the Ethanol Blend Wall: Examining the Science on E15

Thursday, July 7, 2011
2:00 p.m. to 4:00 p.m.
2318 Rayburn House Office Building

PURPOSE

On Thursday, July 7, 2011, the Energy & Environment Subcommittee of the Committee on Science, Space, and Technology will hold a hearing entitled "Hitting the Ethanol Blend Wall: Examining the Science on E15." The purpose of the hearing is to examine the scientific and technical issues related to EPA's recent waiver decisions permitting mid-level ethanol blends of up to 15 percent ethanol ("E15") in gasoline and receive feedback on draft legislative language.

WITNESSES

- **Ms. Margo Oge**, Director, Office of Transportation and Air Quality, U.S. Environmental Protection Agency (EPA)
- **Mr. Bob Greco**, Group Director, Downstream and Industry Operations, American Petroleum Institute
- **Ms. Heather White**, Chief of Staff and General Counsel, Environmental Working Group
- **Mr. Jeff Wasil**, Emissions Certification Engineer, Evinrude Outboard Motors
- **Mr. Mike Brown**, President, National Chicken Council
- **Mr. W. Steven Burke**, President and CEO, Biofuels Center of North Carolina
- **Dr. Ron Sahu**, Technical Consultant, Outdoor Power Equipment Institute

BACKGROUND

Section 211(f) of the Clean Air Act requires that the Administrator of the EPA may not grant a waiver for any fuel or fuel additive that is "not substantially similar" to the existing certification fuel(i.e. regular unleaded gasoline without ethanol added), however, the Administrator may waive the prohibition in 211(f)(1) if the Administrator determines the fuel or fuel additive will "not cause or contribute to a failure of any emission control device or system (over the useful life

of the motor vehicle, motor vehicle engine, nonroad engine or nonroad vehicle in which such device or system is used)." In other words, under Section 211(f)(4), as added by Energy Independence and Security Act of 2007 (EISA), the Administrator may grant a waiver for a prohibited fuel or fuel additive if the applicant is able to demonstrate the new fuel or fuel additive will not cause or contribute to engines, vehicles, or equipment failing to meet their emissions standards over their useful life. Further, 211(f)(4) requires the Administrator to take final action on an application within 270 days of receipt. In 1978, EPA authorized the use of 10 percent ethanol blended gasoline (E10) and, in response to the Renewable Fuels Standard (RFS II) included in EISA which mandated the use of 15 billion gallons of renewable fuel in 2012 and 36 billion gallons by 2022, ethanol producers have called for the Agency to allow an increased proportion of ethanol in gasoline. In particular, a petition[1] filed by Growth Energy and 54 ethanol manufacturers in March 2009 requested that EPA grant Clean Air Act waivers for the use of E15.

In October 2010 and January 2011, EPA partially approved these waivers.[2] The October decision authorized E15 use in model year 2007 and newer light-duty motor vehicles (cars, light-duty trucks and medium-duty passenger vehicles), while the January partial waiver extended E15 use to model year 2001-2006 light-duty motor vehicles. EPA is expected to complete final registration of E15 blends in the near future, triggering the delivery and sale of the new gasoline formulation as early as late 2011. Vehicles older than model year 2001—which represent approximately 32 percent of the motor vehicle fleet[3]—as well as other gasoline-powered products such as outdoor equipment and recreation vehicles remain unapproved for E15 use.

Implications and Technical Issues

This set of EPA decisions has resulted in two overarching technical and practical concerns: (1) the potential for E15 to damage vehicle engines of all model years, as well as off-road engines; and (2) the potential of a newly bifurcated fueling system to result in widespread misfueling of engines (i.e. owners of model year 2000-and-older cars as well as nonroad vehicles and equipment filling their tanks with unapproved E15 gasoline blends).

More specifically, a number of significant technical concerns including emissions, reliability, infrastructure, and liability have been raised about the E15 waiver by a diverse coalition of stakeholders from throughout the automotive and gasoline supply chains, as well as nonroad engine makers, agricultural groups, environmental organizations, and states and localities. Their concerns emphasize the following issues:

- Potential impacts for both light-duty motor vehicle engines as well as non-covered engines including engine failure, corrosion, materials incompatibility, catalyst

[1] Notice of Receipt of a Clean Air Act Waiver Application To Increase the Allowable Ethanol Content of Gasoline to 15 Percent; Request for Comment, April 21, 2009, http://www.epa.gov/fedrgstr/EPA-AIR/2009/April/Day-21/a9115.htm.

[2] Additional waiver information available at: http://www.epa.gov/otaq/regs/fuels/additive/e15/.

[3] According to EPA, 2007 and later model year passenger vehicles represent "nearly 30 percent of the motor vehicle fleet" and vehicles in model years 2001 to 2006 "cover roughly 38 percent." Assistant Administrator Gina McCarthy, Letter to Congressman Joe Barton, September 17, 2010.

degradation, water-in-fuel and phase separation, higher exhaust temperatures, increased pollution emissions, and reduced useful life of a vehicle or product.

- The need for substantially more testing on the use of E15.
- Risk of misfueling with E15 in non-approved engines due to incomplete or inadequate labeling requirements consistent with relevant technical standards.
    - Non-approved engines include not only those in light duty vehicles from model years 2001 and older, they also include the 13 million recreational boats, 200 million outdoor power equipment products, 8 million recreation vehicles and motorcycles, and a variety of other gasoline-powered legacy products currently in use.
- Data from DOE tests was released after the end of the public comment period, and multiple requests for deadline and comment period extension were denied by EPA. The Agency also referred to unreleased "engineering analysis" in determining that no emission control systems would fail in the waived segment of vehicles.[4]
- Responses to letters from Vice Chairman Jim Sensenbrenner indicate that major automakers in this country will not back warranty coverage for vehicles fueled with E15. Many owners' manuals also make this fact clear.[5]

EPA Waiver Criteria and Decision Process

According to a Congressional Research Service summary of the EPA requirements for a Section 211(f) waiver request (and in turn, the criteria for EPA's decision)[6], a submission must:

- include both evaporative and exhaust emissions;
- be comprehensive, assessing the emissions effects both short-term and over the full useful life of the vehicle;
- include tests on a variety of vehicles (e.g., new and used, car, truck, and motorcycle), and the selection of vehicles should reflect their frequency on the road;
- assess the durability of vehicles and vehicle parts using the fuel, including assessments of the compatibility of the new fuel (or blend level) with engine materials, and the effects on operability and performance; and
- [b]ecause gasoline is also used in other engines (e.g., lawnmowers, snowmobiles, boats, etc.), the long-term effects on emissions and engine durability for these engines must also be studied, according to EPA.

Despite a variety of other technical information test data, as well significant gaps in understanding related to mid-level ethanol blends, EPA's rationale for these partial waiver decisions relied almost exclusively on a single set of Department of Energy (DOE) tests

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[4] Assistant Administrator Gina McCarthy, Letter to General Wesley Clark and Jeff Broin of Growth Energy, November 30, 2009.

[5] "Sensenbrenner Hears from Automakers: E15 Bad for Engines, American Consumers," July 5, 2011, http://sensenbrenner.house.gov/News/DocumentSingle.aspx?DocumentID=249952&gt%3B.; Sheila Karpf, "You Could Be On Your Own If Ethanol Messes up Your Engine," May 9, 2011, http://www.ewg.org/agmag/2011/05/you-could-be-on-your-own-if-ethanol-messes-up-your-engine/.

[6] Brent Yacobucci, "Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol "Blend Wall," R40445, July 1, 2011, 8.

conducted in 2009 and 2010 (referred to in both waiver decisions as the "DOE Catalyst Study"[7]). These tests looked at catalyst durability results for 27 high sales volume models (8 models representing 2001 to 2006, and 19 models representing 2007 and newer). Despite criticism of this program as non-representative,[8] there was little opportunity for public discussion and comment as the results of the raw test data were posted to the docket just days prior to the partial waiver decisions. Furthermore, the EPA's decision to justify its ruling overwhelmingly on the DOE Catalyst Study represents a significant narrowing of its originally stated plans. Specifically, a June 2008 presentation of "EPA Staff Recommendations" for testing associated with potential waivers called for pursuing a comprehensive understanding of engine impact issues for vehicles and equipment of all ages.[9]

Additionally, the EPA waiver decisions did not take into account numerous ongoing test programs (nearly all of which have involved DOE and EPA as partners and participants) for a full range of technical and engineering questions related to mid-level ethanol blends such as E15. For example, the Coordinating Research Council (CRC),[10] in cooperation with government entities like EPA and DOE, has developed a comprehensive testing program on the effects of mid-level ethanol blends. The testing timeline offered below[11] shows that significantly more technical data would have been available to EPA decision makers in the near-future:

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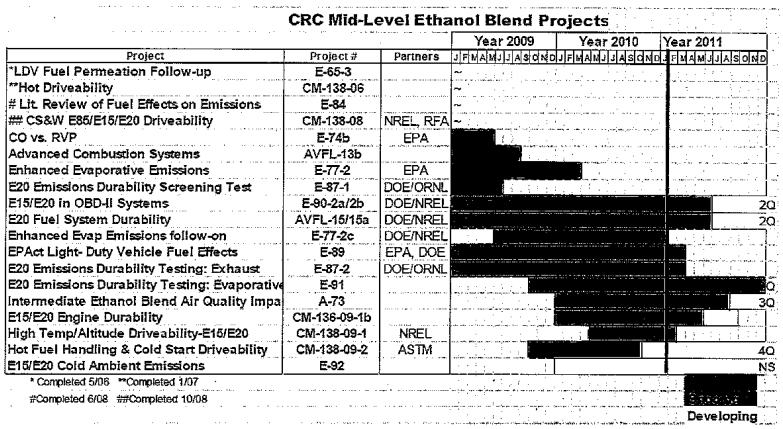
[7] These tests have not been compiled into a report and, according to the Department of Energy, there are no plans to interpret these results accordingly. Data from these tests were added into the waiver docket, including multiple submissions (including a Technical Summary of the test results) on October 12, 2010, the day prior to the EPA Administrator's first waiver decision. These results were posted more than a year after the end of the public comment period on July 20, 2009.

[8] Major criticisms of the test program includes: the tests do not fully consider evaporative emissions, materials compatibility, and drivability/operability concerns; the results indicate emissions failure for some vehicles; the program did not include a model year 2001 vehicle; and that catalyst durability is not the only vehicle durability effect that should be examined. Sheila Karpf, "When it Comes to E15, Never Mind the Data ," May 5, 2011, http://www.ewg.org/agmag/2011/05/when-it-comes-to-e15-never-mind-the-data/; Coleman Jones, General Motors, and Jeff Jetter, Honda, "CRC Research Program on Intermediate Ethanol Blends ," Presentation to Society of Automotive Engineers, January 27, 2011, http://www.sae.org/events/gim/presentations/2011/JonesJetter.pdf.

[9] Karl Simon, EPA, OTAQ, "Mid Level Ethanol Blend Experimental Framework—EPA Staff Recommendations," Presentation to the American Petroleum Institute Technology Committee Meeting, Chicago, June 4, 2008.

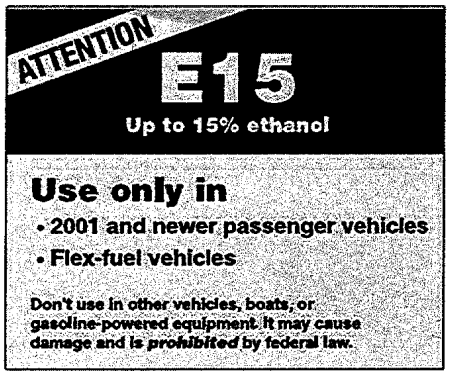
[10] The CRC describes itself as "a non-profit organization that directs, through committee action, engineering and environmental studies on the interaction between automotive/other mobility equipment and petroleum products." The organization "is not involved in any way in regulation, which remains a governmental responsibility; nor is CRC involved in the development of hardware or petroleum products, which remains the responsibility of private industry. The formal objective of CRC is to encourage and promote the arts and sciences by directing scientific cooperative research to develop the best possible combinations of fuels, lubricants, and the equipment in which they are used, and to afford a means of cooperation with the Government on matters of national or international interest within this field." http://www.crcao.com/about/index.html

[11] Jones and Jetter.



Misfueling

On June 23, 2011, EPA issued a final regulation to "help reduce the potential for vehicles, engines, and equipment not covered by the partial waiver decisions to be misfueled with E15." The regulation mandated a new label to be placed on service station fuel pumps around the country when stations choose to sell E15. The labeling decision attracted criticism due to the enormous risk of widespread engine damage and potential environmental consequences associated with misfueling. Specifically, EPA's label requirement ignored alternative technological options and failed to incorporate dominant safety labeling techniques such as the color, signal word, and image recommendations of the American National Standards Institute's Z535 standard. The final EPA label is below:



Legislative Language calling for National Academy of Sciences Review

Appendix A contains a preliminary discussion draft requiring the Administrator of the EPA to enter into an arrangement with the National Academy of Sciences to conduct an evaluation and assessment of the full suite of technical data, gaps in understanding, and research and development needs related to the deployment and use of mid-level ethanol blends. Witnesses have been asked to comment on this language.

Appendix A
Discussion Draft

Section 1. Definitions- In this section:

(1) ADMINISTRATOR- The term `Administrator' means the Administrator of the Environmental Protection Agency.

(2) MID-LEVEL ETHANOL BLEND- The term `mid-level ethanol blend' means an ethanol-gasoline blend containing greater than 10 percent ethanol by volume that is intended to be used in any conventional gasoline-powered motor vehicle or nonroad vehicle or engine.

Section 2. Evaluation

(1) IN GENERAL –Not later than 45 days of enactment of this Act, the Administrator, acting through the Assistant Administrator of the Office of Research and Development at the Environmental Protection Agency, shall enter into an arrangement with the National Academy of Sciences to provide a comprehensive assessment of the scientific and technical research on the implications of the use of mid-level ethanol blends, including an evaluation of the research comparing ethanol-gasoline blends containing 15 percent ethanol with ethanol-gasoline blends containing 10 percent ethanol.

(2) CONTENTS – The assessment performed under subsection (1) shall—

(A) Evaluate the short-term and long-term environmental, safety, durability, and performance effects of the introduction of mid-level ethanol blends on onroad, nonroad and marine engines, onroad and nonroad vehicles, and related equipment. Such evaluation shall include a review of all available scientific information, gaps in understanding, and research needs related to—

(1) Tailpipe emissions;
(2) Evaporative emissions;
(3) Engine and fuel system durability;
(4) On-board diagnostics;
(5) Emissions inventory and other modeling effects;
(6) Materials compatibility;
(7) Operability and drivability;
(8) Fuel efficiency; and
(9) Adequate pump labeling consistent with applicable technical standards and recommendations of the National Institute of Standards and Technology, the American National Standards Institute, and the International Organization for Standardization.

(3) REPORT – Not later than 1 year after the enactment of this Act, the National Academy of Sciences shall submit to the Committee on Science, Space, and Technology a report on the results of the evaluation.

Section 3. Authorization of Appropriations.
In order to carry out this Act, the Administrator shall utilize funds made available under P.L. 96-569.

Chairman HARRIS. The Subcommittee on Energy and Environment will come to order. Good afternoon. I want to thank the witnesses and the folks in the audience for your patience. We just finished a round of voting, but the good news is we won't have another round until well after this hearing is over.

I am going to start with my opening statement. I want to thank our witnesses for being here today to testify on the scientific and technical issues associated with the Environmental Protection Agency's decision to grant a partial waiver for the use of fuel blends containing up to 15 percent ethanol, known as E15.

At the outset, I would like to make clear that this hearing is not about picking winners and losers among fuels, or whether ethanol production is inherently good or bad. This hearing will focus specifically on the question: Did the EPA use the best available science when granting a partial waiver for the use of E15, and if not, what issues remain unanswered and what are the potential impacts on the hundreds of millions of engines that will consume E15 fuel in the very near future?

Due to this technical focus, we have invited witnesses that will be directly impacted by this decision to testify on the scientific and data quality issues related to mid-level ethanol blends. While the details associated with the EPA E15 decisions are complex and esoteric, their impacts are potentially massive. The properties of ethanol are very different from gasoline, and they may result in problems associated with corrosion, engine failure, increased emissions, materials incompatibility, infrastructure, warranty coverage and the potential for misfueling.

Every American that uses a car, boat, motorcycle, tractor, lawnmower or other any other gasoline-powered equipment could be negatively affected. As we will hear today, a diverse coalition of interest groups have highlighted the need for greater scientific certainty and more testing for E15. And thanks to the effort of Vice-Chairman Sensenbrenner, we now have most automakers on record asserting that EPA testing failed to determine that E15 won't be harmful to car engines, and that warranties may not cover any resulting damages.

Why, then, did EPA issue enormously impactful rulings largely on the basis of a single test program conducted by the Department of Energy? We are here today to answer this question, but based on available information it appears safe to say it was not a science-driven decision that comprehensively addresses the technical concerns identified by stakeholders.

Meanwhile, the EPA job-killing machine marches on, driven by a regulate-at-all-costs mentality and unencumbered by facts. From ethanol to climate regulations to agricultural policies, the experience in my district illustrates how EPA is strangling the economy, and more often than not it is doing so on the basis of weak science.

Last month, a nearly 100-year-old poultry company, Allen Family Foods, filed for bankruptcy. This company is a major employer on the Eastern Shore of Maryland. It is the second-largest employer in Talbot County with more than 500 employees at one of its single plants in Cordova, Maryland. The combination of skyrocketing feed prices driven by our ethanol policy and job-killing regulations by EPA has now forced this 100-year-old company to shut its doors.

Last, I want to emphasize that E15 is not a partisan issue. In February, the House voted overwhelmingly in favor of an amendment that would have defunded EPA's implementation of the E15 waiver decision for this fiscal year. Although that language did not become law, the issue clearly remains unresolved. I believe this Subcommittee can play an important role in advancing this debate, consistent with past efforts to examine the scientific and technical underpinnings of fuel formulations and vehicle and biofuels technologies more generally.

To that end, we have asked witnesses to comment on very brief legislative language that would direct the EPA to contract with the National Academy of Sciences for an independent assessment of the state of the science regarding E15.

I look forward to receiving feedback on this preliminary language, and I want to thank the witnesses again for appearing before us today.

[The prepared statement of Mr. Harris follows:]

PREPARED STATEMENT OF CHAIRMAN ANDY HARRIS

I thank our witnesses for being here today to testify on the scientific and technical issues associated with the Environmental Protection Agency's decision to grant a partial waiver for the use of fuel blends containing up to 15 percent ethanol, known as "E15."

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Meanwhile, the EPA job-killing machine marches on, driven by a regulate-at-all-costs mentality and unencumbered by facts. From ethanol to climate regulations to agricultural policies, the experience in my District illustrates how EPA is strangling the economy, and more often than not it is doing so on the basis of weak science. Last month, a nearly-100-year-old poultry company, Allen Family Foods, filed for bankruptcy. This company is a major employer on the Eastern Shore; It is the 2nd-largest employer in Talbot County, with more than 500 employees at a single plant in Cordova. The combination of skyrocketing feed prices driven by our ethanol policy and job-killing regulations by EPA has now forced this company to shutter its doors.

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I look forward to receiving feedback on this preliminary language, and I want to thank the witnesses for appearing before us today.

Chairman HARRIS. The Chair now recognizes Ranking Member Miller for five minutes for an opening statement.

Mr. MILLER. Thank you, Chairman Harris, for the opportunity to hear about current policies regarding renewable fuels and E15.

Renewable fuel from biomass, specifically corn-based ethanol, is a complex and controversial issue, and as the panel before us demonstrates, there are many different interests and opinions regarding the ethanol content of our Nation's fuel supply.

I understand this hearing was supposed to examine the science and testing EPA used in its decision to allow the introduction of E15 to the market, and we may not all agree with the EPA's decision or about their decision, but we should be interested in learning more about the underlying science as well as the positive and negative effects that this decision may have.

Unfortunately, given the lopsided panel and the sprawling focus of this hearing, I am concerned that we will leave here only slightly more informed about the science around E15 and no closer to agreement on what steps, if any, Congress should take. I agree with Chairman Harris' statement a little moment ago that the EPA should not proceed unencumbered by facts. Neither should this Subcommittee.

Just as we demand that the executive branch work in an efficient, transparent manner, we should also have a clear picture of what we are trying to accomplish within our Committee. Since being notified about this hearing and up until the end of last week, again, Monday was a holiday, we have seen everything from the purpose and scope of the hearing to the selection of witnesses broaden and change. And as a result, I anticipate critical gaps in this Committee's record.

Much of the science EPA used in making its waiver decision was conducted by the Department of Energy. In fact, DOE's role is the only piece of this issue that is firmly within this Committee's jurisdiction. But the majority did not invite the DOE to the Subcommittee to testify today. It does not inform our understanding of the science if we do not have DOE here to discuss the extensive testing that they conducted. It also violates pretty basic ideas of fairness, that we will have witnesses criticize DOE, and DOE is not here to tell their side of the story.

Just last Thursday the witnesses, along with the minority, received draft legislation on which they were instructed to testify. While the draft is neither particularly complex nor ambitious, that is hardly time for the witnesses to review the material in advance, to submit their testimony, especially again given the holiday Monday.

Within the last few weeks, the Vice-Chairman of the Full Committee, writing on Committee stationery, Mr. Sensenbrenner, sent letters to the automotive and small engine industry from the Committee on the issue of E15. The minority received the response to

those letters just two days ago, and on Tuesday of this week, the day before yesterday, Mr. Sensenbrenner sent a letter to the EPA asking several questions about E15 and setting a deadline of July 22 for the EPA to respond.

If our task is to conduct oversight, thorough oversight, we should have waited to hear back from the EPA before holding this hearing and certainly not before we ask witnesses and Members to review the legislation. It appears that the majority already has drawn its conclusions on the subject without considering EPA's responses or the DOE's explanation of the research, and this hearing is a formality. To build a legislative record on a bill that may or may not be, probably is not in fact within our jurisdiction.

Mr. Chairman, the EPA should not act half-cocked. We agree on that. They should not act on incomplete information without considering the views of the people who are most affected by their actions. Neither should this Subcommittee. Clean and sustainable and renewable fuels are already a part of our economy, and we need to work together toward realizing future producing homegrown renewable fuels. In this grand challenge, it is this Committee's task to focus on the science and technology. That is why I have invited Mr. Burke from North Carolina today. He will provide a different perspective from the rest of the panel on renewable fuels and discuss how science and technology will help our country get on the road to a sustainable energy future.

And with that, I look forward to all of our witness's testimony and what I hope will be an honest discussion about the scientific and technological implications of our continued migration from oil to alternative fuels. Thank you. I yield back my time.

[The prepared statement of Mr. Miller follows:]

PREPARED STATEMENT OF RANKING MEMBER BRAD MILLER

Thank you, Chairman Harris, for the opportunity to hear about current policies regarding renewable fuels and E15. Renewable fuel from biomass, specifically corn-based ethanol, is a complex and controversial issue. And, as this panel demonstrates, there exists a vast array of interests and opinions regarding the ethanol content of our nation's fuel supply.

I understand that this hearing was supposed to examine the science and testing EPA used in its decision to allow introduction of E15 in the market. We may not all agree with the EPA's decision, but we should be interested in learning more about the underlying science as well as the range of positive and negative effects this decision may have. Unfortunately, given the lopsided panel and sprawling focus of this hearing, I am concerned that we will leave here only slightly more informed about the science around E15, and no closer to agreement on what steps, if any, the Congress should take.

Just as we expect the Executive Branch to work in an efficient, transparent, manner, we should also have a clear picture of what we are trying to accomplish with our Committee actions. Sadly, since being notified about this hearing, and up until the end of last week, we have seen everything from the purpose and scope of the hearing to the selection of the witnesses: broaden and change. I anticipate critical gaps in the Committee's record on the subject.

Much of the science EPA used in making its waiver decision was conducted by the Department of Energy. In fact, DOE's role is the only piece of this issue firmly within this Committee's jurisdiction. But unfortunately the Majority did not invite DOE to the Subcommittee today to testify. I do not see how we get a clear picture of the science if we do not have DOE here to discuss the extensive testing they conducted. With seven witnesses on one panel—surpassed this Congress only by an 8-person panel, half of which were children—I would expect to hear a wide variety of perspectives on ethanol. Unfortunately with such a crowded and diverse panel, and such little time for discussion, it will be difficult for members and witnesses to examine the issue in detail. Furthermore, despite the size of this panel, we are

still missing some critical stakeholders. The motives for not inviting the ethanol industry are clear, and made even clearer by instead inviting the oil industry to testify. I find it hard to accept that we will get a balanced view on the E15 waiver controversy without testimony from either the ethanol industry or the Department of Energy.

Furthermore, just last Thursday the witnesses, along with the Minority, received draft legislation on which they were instructed to testify. Granted, the draft is neither particularly complex nor ambitious. But, in my opinion, this was hardly enough time for witnesses to thoroughly review the material in advance of their deadlines to submit testimony, especially given the holiday.

Additionally, within the last few weeks the Vice-Chairman of the Full Committee, Mr. Sensenbrenner, has sent letters to the automotive and small engine industry from the Committee on the issue of El5. The Minority only received the responses to these letters two days ago. Then, on Tuesday of this week Mr. Sensenbrenner sent a letter to the EPA asking several questions about E15 and setting a deadline of July 22nd for EPA to respond.

Mr. Chairman, if our task is to conduct thorough oversight then I would have expected us to wait to hear back from EPA before holding a hearing, and certainly before we ask witnesses and Members to review legislation.

I fear that the Majority has already drawn its conclusions on the subject without considering EPA's responses, and that this hearing is merely a formality in building a legislative record on a bill that may not even be within our jurisdiction.

If the take-away message from this hearing is that EPA is making policy prematurely, based on incomplete data, and without considering the range of important stakeholder perspectives, then I must point out the irony in how this hearing and the proposed legislation have been developed.

Opposition and support of ethanol certainly crosses party lines, but I cannot help but see this hearing as part of the coordinated partisan attack on clean energy.

Clean and sustainable renewable fuels are already a part of our economy; and we need to work towards realizing a future of producing home grown renewable fuels. In this grand challenge, it is this Committee's task to focus on the science and technology: That is why I have invited Mr. Burke from North Carolina to testify today. He will provide a different perspective from the rest of the panel on renewable fuels and discuss how science and technology will help our country get on the road to a sustainable energy future.

With that, I look forward to all of the witness's testimony, and to what I hope will be an extended discussion about the scientific and technological implications of our continued migration from oil to alternative fuels. Thank you.

Chairman HARRIS. Thank you very much, Mr. Miller. If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time I would like to introduce our witness panel. Ms. Margo Oge is the Director of the Office of Transportation and Air Quality at the Environmental Protection Agency where she has worked since 1980.

Mr. Bob Greco is the Group Director for Downstream and Industry Operations at the American Petroleum Institute. Prior to his 21-year career at API, Mr. Greco was an Environmental Engineer with EPA.

Ms. Heather White is the Chief of Staff and General Counsel at the Environmental Working Group. She has previously served as director of Education Advocacy at the National Wildlife Federation and as counsel to U.S. Senator Russ Feingold on energy and environmental issues.

Mr. Jeff Wasil is Emissions Certification Engineer for BRP Evinrude, Marine Engine Division. He is here today to testify on behalf of the National Marine Manufacturers Association.

Mr. Mike Brown is the President of the National Chicken Council, a trade association representing over 95 percent of the chickens produced in the United States. Mr. Brown was previously Senior Vice President at the American Meat Institute.

Ranking Miller has asked for the opportunity to introduce our next witness, Mr. Steven Burke. I now recognize Mr. Miller for up to two minutes for his introduction.

Mr. MILLER. Thank you. Mr. Burke became the President and CEO of the Biofuels Center of North Carolina in March of 2009. He served as Founding Board Chair from July of 2007 until that date and as Acting President since August 2008. The Biofuels Center is a private, non-profit corporation established by the State of North Carolina to craft and implement a policy commitment for a sustained state-wide biofuels initiative. Mr. Burke departed the North Carolina Biotechnology Center in 2009 as Senior Vice President for Corporate Affairs, and for more than 24 years he helped shape the approach and strategies of the Biotechnology Center, the world's first targeted initiative for biotechnology development. Before joining the Biotechnology Center in 1985, as its fifth employee, he taught instructional design at North Carolina State University in Raleigh. I am very happy to have Mr. Burke here from North Carolina. We have met a number of times, and I believe his perspective will add to the discussion today. Thank you.

Chairman HARRIS. I thank you, Mr. Miller. Our final witness is Dr. Ron Sahu, an independent technical consultant who has provided consulting services to the EPA and others on a variety of environmental matters. He is here today on behalf of the Outdoor Power Equipment Institute, a trade association whose members make a wide range of outdoor power equipment including lawn and garden equipment. Dr. Sahu holds a Master's and a Ph.D. in Mechanical Engineering from the California Institute of Technology. And I want to thank you all for appearing before the Subcommittee today.

As our witnesses should know, spoken testimony is limited to five minutes each, after which the Members of the Committee will have five minutes each to ask questions.

I now recognize our first witness, Margo Oge, from the Environmental Protection Agency.

STATEMENT OF MS. MARGO OGE, DIRECTOR, OFFICE OF TRANSPORTATION AND AIR QUALITY, U.S. ENVIRONMENTAL PROTECTION AGENCY

Ms. OGE. Mr. Chairman, Members of the Subcommittee, I really appreciate the opportunity to testify on EPA's response to a request by ethanol producers to allow higher levels of ethanol in gasoline for use in conventional vehicles.

Ethanol producers filed a request in March of 2009 that EPA increase the permissible concentration of ethanol in gasoline to 15 percent which EPA granted in part and denied in part. An EPA decision to grant a waiver by no means requires that E15 must be used or sold in the marketplace.

Now in researching this decision, EPA considered all the available evidence, including extensive test data developed by the Department of Energy and other researchers. In fact, we believe that the waiver record is extensive and strong. It includes DOE's, Department of Energy's testing of 19 vehicle models to provide statistically sound conclusions about model year 2007 and newer vehicles and their ability to meet exhaust emissions standards. It also in-

cludes the Department of Energy's study for model year 2001—2006 vehicles, that tests models that were selected because of their sensitivity to high ethanol levels.

Now, those studies along with other information, several CSE reports, EPA compliance data, manufacturer certification data, in-use testing and manufacturers' defect reports provided the relevant information for the Administrator to make a decision about the potential impacts of E15, not just for the exhaust emissions but also for evaporative emissions, material compatibility and drivability.

We did not wait for the result of several ongoing studies because the records in front of us were sufficient without those studies, and I must tell you that many of the studies that are still being done, they are not designed to answer the specific question before EPA: Would E15 cause or contribute to failure of emissions standards when the vehicles and engines were designed? In sum, extensive testing data and other information before EPA, we believe, providesa strong technical basis for the Administrator's decision to allow E15 to be sold on model year 2001 and newer light-duty vehicles. We also found that E15 did not meet the Clean Air Act requirement in the case of vehicles older than 2001 and off-road gasoline-powered equipment.

In making the waiver decision EPA also fully complied with applicable legal requirements under the Clean Air Act for public notice and comment. Section 211(f) of the Clean Air Act specifically requires that we provide public notice and an opportunity to comment on E15 waiver applications. The Agency believes that we have met that requirement.

To reduce the potential for misfueling with E15, we have established several measures that draw on many years of experience with fuel transitions. In the waiver decision, EPA required fuel producers that decide to introduce E15 into the marketplace to develop and implement a misfueling plan including the labeling of E15 pumps. Let me make it clear that a number of additional steps are needed before E15 can enter the marketplace.

Many are not under EPA's control. We have not yet received a complete application by the renewable fuel producers that is required under the Clean Air Act to register E15, and only if E15 is registered, can be introduced into the commerce.

In addition, retail stations that want to sell E15 will need to consider the compatibility of their underground storage tanks based on recently issued EPA guidance. Stations that want to sell E15 will need to consider whether changes are needed to fuel dispensing equipment, and many states, as you may know, rely on ASTM procedures before new fuels are introduced into the marketplace.

As E15 enters the marketplace, EPA is committed to work with all stakeholders to monitor the development and help address any potential issues that may arise.

Thank you very much for the opportunity, and I look forward to answering any of your questions.

[The prepared statement of Ms. Oge follows:]

PREPARED STATEMENT OF MS. MARGO T. OGE, DIRECTOR, OFFICE OF TRANSPORTATION AND AIR QUALITY, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman, Members of the Subcommittee, I appreciate the opportunity to come before you today to testify on EPA's response to a request by ethanol pro-

ducers to allow gasoline containing more than 10% ethanol and up to 15% ethanol (E15) to enter the marketplace.

Under the Clean Air Act (the Act), companies cannot increase the concentration of ethanol in gasoline unless the Administrator determines that the increased concentration will not cause or contribute to the failure of vehicles or engines to meet emissions standards. To date, the Act allows gasoline containing up to 10% ethanol to be introduced into commerce for use in conventional-fueled vehicles and fuel containing up to 85% ethanol to be introduced for use in flexible-fueled vehicles. Ethanol producers filed a request that EPA increase the permissible concentration of ethanol in gasoline to 15 percent, which EPA granted in part and denied in part.

In reaching this decision, EPA considered all of the available evidence, including extensive test data developed by the Department of Energy (DOE) and other researchers. Based on this evidence, EPA determined that the Clean Air Act criteria were met for allowing E15 to be introduced into commerce for use in model year (MY) 2001 and newer cars, light trucks and other passenger vehicles. EPA also found that the Act's criteria were not met for older passenger vehicles and other types of vehicles and gasoline-powered equipment because there were insufficient data to allay engineering concerns that the less sophisticated engines and emission controls of these products could accommodate E15.

As a result, EPA raised the permissible concentration of ethanol in gasoline to 15 percent for gasoline for use in MY 2001 and later passenger vehicles, but did not raise the permissible concentration in gasoline for other uses. To reduce the potential for misfueling with E15, EPA required that fuel producers that decide to introduce E15 into commerce take a number of steps, including labeling E15 pumps. In addition, the Agency recently issued national regulations to further reduce the risk of misfueling.

As a new gasoline, E15 must be registered under the Clean Air Act before it may be introduced into commerce. Since EPA has yet to receive or act on a complete E15 registration application, E15 may not yet be lawfully sold.

The Clean Air Act Fuel Waiver Process

Under the Clean Air Act, EPA has an important but limited role to play in determining whether a new fuel or fuel additive may enter the market. To protect public health and the environment, the Agency sets standards to control air pollution from many kinds of sources, including cars, trucks and non-road engines and equipment. To protect the ability of mobile sources to meet those standards, the Clean Air Act prohibits the introduction into commerce of motor vehicle fuel that is not "substantially similar" to the fuel used to determine whether those sources meet emission standards. Manufacturers of cars, trucks and equipment design their products to meet standards based on use of the fuel in EPA's test procedures.

For fuels like E15 that are not substantially similar to test fuel, the Clean Air Act authorizes EPA to grant a waiver of the prohibition against introduction into commerce if a demonstration is made that the fuel will not cause or contribute to vehicles or engines failing to meet applicable standards over their full useful life. The Act requires EPA to respond to a waiver request within 270 days of receipt and to provide public notice of, and an opportunity to comment on, the waiver application.

In acting on waiver requests since the 1970s, EPA has articulated two basic approaches for making the required demonstration of a new fuel's emissions impact—(1) a representative, statistical sampling and testing program, or (2) a reasonable engineering theory about emissions effects and data to confirm the theory. Both of these approaches reflect that it is not feasible to test every vehicle or piece of equipment to determine how its emissions would respond to a new fuel. Instead, each approach calls for sufficient data to reasonably conclude that the new fuel will not cause or contribute to failure to meet emissions standards. The burden is on the waiver applicant to make the demonstration, although EPA considers information submitted by the public and other available information in making its waiver decisions. An EPA decision to grant a waiver request allows, but does not require, the waived fuel to be made or sold.

The E15 Waiver Request and Decision

EPA received a waiver request for E15 from Growth Energy and 54 ethanol producers in March 2009. The Agency sought public comment on the application, including the information submitted in support. EPA notified the waiver applicants in November 2009 that there was not sufficient data to support granting the waiver request at that time. However, in light of an ongoing DOE test program on component durability, the Agency stated that it would wait to make a decision on the waiver request until the results of the vehicle test program were available.

DOE had begun developing the vehicle test program in 2007 to study the potential effects of ethanol blends greater than E10 on conventional gasoline-fueled vehicles and equipment. This was done in response to both President Bush's initiative to reduce petroleum consumption by 20% in 10 years and enactment of the Energy Independence and Security Act (EISA). As part of EISA, Congress required a significant increase in the amount of biofuels that must be added to transportation fuel under the Renewable Fuel Standard (RFS) program. DOE developed this test program as part of a larger DOE effort to identify different pathways for meeting the ambitious RFS2 volume requirements, considering vehicle technology, allowable levels of ethanol in fuel, the fuel distribution network, and other factors. DOE consulted with EPA and a wide array of stakeholders in designing its vehicle test program.

After the E15 waiver request was submitted, DOE modified its test program so that it would produce data useful for making a waiver determination. In view of EISA's bipartisan mandate for increasing biofuels as a means of reducing petroleum use and emissions, a concerted effort was made to expedite the testing and share the results with stakeholders and the public. As EPA indicated in a letter to the Alliance of Automobile Manufacturers and on its webpage, DOE's test data were placed in the docket for the waiver request as the data became available and were checked for accuracy and completeness. This allowed members of the public to review and comment on it, as many did. EPA also responded to inquiries about the test data.

As DOE testing was completed, first for MY2007 and newer light-duty vehicles and later for MY2001–06 light-duty vehicles, EPA considered the test data along with other available information to determine whether the statutory test for granting waivers had been met. Based on the sound technical rationale detailed in the Agency's October 2010 and January 2011 waiver decision documents, the Administrator concluded in these decisions that the statutory criteria were met for MY2001 and newer light-duty vehicles and not for older such vehicles or other types of vehicles, engines and equipment. The Administrator's decision thus increased the permissible concentration for ethanol to 15 percent, but only for use in MY2001 and newer light-duty vehicles.

To protect other vehicles, engines and equipment from being misfueled, the Administrator's decision placed conditions on the introduction of E15 into commerce for use in MY2001 and newer light-duty vehicles. It also included conditions to ensure ethanol quality and volatility control. Rather than attempt to reiterate here EPA's extensive technical basis for granting the waiver in part and denying it in part, I refer you to the decision documents and welcome the opportunity to answer any questions you may have about the decisions.

Related Steps

To further reduce the risk of misfueling, EPA recently issued a final rule establishing national requirements for E15 pump labeling, product transfer documents and retail station surveys. We received many suggestions and comments about how we could improve our proposed misfueling mitigation program, and we believe the final rule is stronger as a result. We worked closely with labeling experts from the Federal Trade Commission in designing a label that effectively communicates the essential information consumers need to avoid misfueling. We also enhanced the ability of product transfer documents to communicate the information fuel blenders, distributors and retailers need to properly blend and market E15. It is important to note that the misfueling mitigation rule requirements are designed to work in tandem with the related conditions of the partial waivers, so that the fuel producers benefitting from the waivers continue to have an important role to play in mitigating misfueling.

A number of additional steps need to be taken before E15 can enter the market, and many of those steps are not under EPA's control. As I indicated previously, we have not yet received a complete application to register E15 as required by the Clean Air Act. Stations that want to sell E15 will need to consider whether changes are needed to fuel dispensing equipment to meet other federal, state and local requirements. Since a number of states restrict the sale of gasoline-ethanol blends, law changes may also be needed in those states before E15 may be sold there. EPA has a role in setting standards for the compatibility of existing underground storage tanks (UST) with E15, and the agency recently issued guidance to help UST owners and operators meet existing federal UST compatibility requirements. As E15 enters the marketplace, EPA is committed to working with stakeholders to monitor developments and help address any issues within the Agency's jurisdiction.

Thank you for the opportunity to testify today.

Chairman HARRIS. Thank you very much. Mr. Greco?

STATEMENT OF MR. BOB GRECO, GROUP DIRECTOR, DOWNSTREAM AND INDUSTRY OPERATIONS, AMERICAN PETROLEUM INSTITUTE

Mr. GRECO. Thank you. Good afternoon, Mr. Chairman, Members of the Subcommittee, my name is Bob Greco, and I am Downstream Group Director for the American Petroleum Institute, API. Thank you for the opportunity to testify today on EPA's premature decision to grant a partial waiver allowing ethanol blends of up to 15 percent in gasoline, otherwise known as E15.

API represents over 470 member companies involved in all aspects of the oil and natural gas industry. API members provide the fuels that keep America running.

API supports the continued, appropriate use of ethanol to help meet our Nation's energy demand. With the Renewable Fuel Standard, or RFS2, biofuels are an increasingly significant part of the transportation fuel mix. However, E15 is a new transportation fuel that contains 50 percent more oxygen, well outside the range for which U.S. vehicles and engines have been designed and warranted. It is thus critically important to evaluate the short- and long-term impacts of this new fuel on the environment and on engine and vehicle performance and safety.

Shortly after the enactment of the Energy Independence and Security Act in 2007, the oil and auto industries and other stakeholders, including EPA and DOE, recognized that substantial research was needed to assess the compatibility of higher ethanol blends with the existing vehicles and small engines. Through the Coordinating Research Council, or CRC, the oil and auto industries developed and funded a comprehensive multi-year test program, which was actually initiated prior to the E15 waiver application.

My written testimony includes additional background on the CRC. The oil and auto industries have contributed close to $14 million towards mid-level ethanol blends research over the past several years. Attachment 1 of my written testimony lists the CRC research programs and are scheduled for completion.

This research examines the following areas: the durability of the engine itself, particularly the engine valves and valve seats; the durability of the fuel storage and handling equipment; the computerized on-board diagnostic system, or OBD, which the driver often sees as their check engine light; and the vehicle evaporative emissions control system, which minimizes the release of fuel vapors to the atmosphere. I disagree with Margo about whether these are emissions-related or not, and we can talk about that during the comment period.

Most of this work will be completed by year's end. However, the preliminary test results in which at least two program areas, engine durability and fuel system durability, suggest that further investigation is warranted.

We shared the schedule and preliminary test results with EPA on several occasions, but the agency ignored this research. Instead of waiting for the CRC studies to be completed and thoroughly evaluated, EPA improperly used the data from the DOE catalyst durability program and drew conclusions about E15 effects for which this DOE program was not designed to evaluate.

In addition, research is being conducted on E15's compatibility with gas station pumps, hoses, nozzles, gaskets and underground storage equipment. This work is in partnership with EPA and two DOE national labs, Oakridge National Lab and the National Renewable Energy Lab, or NREL.

NREL's research indicates that 70 percent of the used equipment tested and 40 percent of the new equipment tested yielded either non-compliant or inconclusive test results. These are potentially serious safety concerns for consumers and gas station attendants from dispensing E15 from any equipment that is not specifically listed for its use.

EPA recently released their gasoline pump labeling rule, and API has serious concerns with their approach. The rule weakened the final label design from what they originally proposed.

In conclusion, EPA's desire to allow more ethanol in fuels cannot be allowed to harm our customers investments in safe, reliable and economical transportation. If consumer satisfaction and safety are compromised, the credibility of not only future biofuels but the entire RFS2 program will be questioned and challenged. That is why the oil and auto industries are supporting a comprehensive test program through the CRC, and testing has revealed reasons for concern.

The E15 waiver controversy, however, points to the larger problem with the RFS2 mandates. The amount of biofuels required is fast approaching the limit of the vehicle fleet to safely utilize them. Within the next year or so, this blend wall will likely be exceeded, and refiners are greatly concerned about complying with an unworkable mandate.

API urges Congress to seriously examine this looming issue and realign the biofuels mandates to fit the capabilities of the vehicle fleet. A premature E15 waiver is not the solution.

Thank you for your time today, and I look forward to answering your questions.

[The prepared statement of Mr. Greco follows:]

PREPARED STATEMENT OF MR. BOB GRECO, GROUP DIRECTOR, DOWNSTREAM AND INDUSTRY OPERATIONS, AMERICAN PETROLEUM INSTITUTE

Good afternoon, my name is Bob Greco and I am Group Director of Downstream and Industry Operations for the American Petroleum Institute (API). Thank you for the opportunity to testify today on the decision by EPA to prematurely grant waivers that allow ethanol blends of up to 15% (E15) in gasoline for a subset of the U.S. light duty vehicle population. API is a national trade association representing over 470 member companies involved in all aspects of the oil and natural gas industry. API members provide the fuels that keep America running.

API supports the continued, appropriate use of ethanol and other renewable fuels to help meet our nation's energy demand. With implementation of the Renewable Fuel Standard (RFS2), biofuels are becoming an increasingly significant part of the transportation fuel mix. E15 constitutes a new transportation fuel. E15 blends increase the oxygen content of gasoline by 50%, well outside the range for which US vehicles and engines have been designed and warranted. E15 also dramatically impacts gasoline service station infrastructure as it is incompatible with most fuel filling equipment. This makes E15 a fuel outside the range for which such equipment has been listed and proven to be safe and compatible and results in conflict with existing worker and public safety laws outlined in OSHA and Fire Codes. For these reasons, it is critically important to evaluate the full range of short- and long-term impacts of increasing the amount of ethanol in gasoline blends on the environment and also on engine and vehicle performance and safety to protect consumers.

In response to the passage of the Energy Independence and Security Act (EISA), the oil and natural gas industry, the auto industry, and other stakeholders, includ-

ing EPA and DOE, recognized in early 2008 that substantial research was needed in order to assess the impact of higher ethanol blends including the compatibility of ethanol blends above 10% (E10+) with the existing fleet of vehicles and small engines. Through the Coordinating Research Council (CRC), the oil and auto industries developed and funded a comprehensive multi-year testing program, prior to the E15 waiver application. API worked closely with the auto and off-road engine industries and with EPA and DOE to share and coordinate research plans. API is committed to continuing this research into the E10+ issue until sufficient research has been completed to assess the impact of introducing a new fuel in order to protect and consumers and the environment. We believe that EPA prematurely approved the E15 waiver request, and did not wait until this research effort was finished and the results were thoroughly evaluated.

About the Coordinating Research Council

The Coordinating Research Council (CRC) is a non-profit organization, established in 1942, that directs, through committee action, engineering and environmental studies on the interactions of transportation fuels with vehicles and engines. The objective of CRC is to encourage and promote the arts and sciences by directing scientific cooperative research to develop the best possible combinations of fuels, lubricants, and the equipment in which they are used, and to afford a means of cooperation with the government on matters of national or international interest. Through CRC, professionals in the automotive and in the energy industries collaborate in research and often coordinate with government agencies such as DOE, EPA and others.

Scope of the CRC E10+ Research

As mentioned earlier, key concerns of the auto and oil industries regarding the E15 waivers are fuel compatibility with infrastructure and engines, vehicle performance, and the overriding need for consumer satisfaction and safety. The EPA's desire to prematurely permit more ethanol to be used in conventional vehicles cannot be allowed to harm the investments made by our common customers in safe, reliable and economical vehicular transportation. The oil and auto industries cannot support a premature action that could put consumer satisfaction, safety and the environment at risk. If consumer satisfaction, safety and the environment are compromised, the credibility of future ethanol products and the RFS2 program will be questioned and challenged. *The CRC research has revealed reasons for concern with the use of mid-level blends in gasoline-powered vehicles.* Although several important and fundamental parts of this comprehensive research program remain incomplete to-date, the program is on track and is producing results needed to understand the impacts of E15. As a result, we continue to support the CRC auto/oil industry testing program and have committed funds through its completion.

Attachment 1 shows our anticipated schedule for completion which goes through the end of 2011 and into 2012. We shared this schedule as well as on-going research progress and results with EPA on several occasions prior to EPA making a decision to issue the partial waivers; EPA chose to ignore the CRC research.

The auto and oil industries have contributed close to $14 million towards mid-level blends research over the past several years targeted specifically at fuel compatibility and engine performance issues that could impact consumers. This funding commitment demonstrates our concern and the seriousness with which we view the potential for vehicle and equipment performance issues that could have a negative impact on customer acceptance and, potentially, the environment. DOE funded a Catalyst Durability Study which was targeted at determining effects of mid-level ethanol blends on catalytic converters.

Automakers upgrade their engine designs, fuel systems, and emissions control systems for E85 flex-fuel vehicles in the US. We need to know whether similar upgrades might be needed for mid-level ethanol blends. Accordingly, we are continuing to do research in the following areas:

Evaluation of Engine Durability

This program looks at the effects of mid-level ethanol blends on vehicle engine durability. A key engine part that may be adversely affected by increased ethanol levels is the cylinder head, a part that costs about $3,500 to replace and many engines have two.

Attachment 2 shows preliminary test results. To date, 3 out of 8 vehicles tested failed on E20 and E15. One vehicle that failed on E20 and E15 passed on E0. Additional testing is underway and should be completed in late 2011.

Evaluation of Vehicle Fuel Storage and Handling Equipment Durability

This program studies the effect of mid-level ethanol blends on the durability of parts that come into contact with the liquid fuel. An example is a fuel pump that can cost $500 to replace. Recent recalls of late model vehicles that have experienced issues with 10% ethanol blends highlight concerns with these components. Attachment 3 shows an example of a problem that can occur with fuel level sensors when exposed to high levels of ethanol. In this particular example, the fuel level sensor experienced a significant open circuit near the "full tank" position. This would result in erratic/false fuel gauge readings for the consumer and could create potential safety problems. This program should be completed by the end of 2011.

On-Board Diagnostics Evaluation

This program looks at the effect of mid-level ethanol blends on the vehicle's On-Board Diagnostic (OBD) system. This computerized system checks the vehicle emission control system to ensure it is working properly. Many states use OBD as part of their in-use monitoring programs to maintain local air quality.

Increased ethanol levels in fuel could trigger MILs (malfunction indicator or "check engine" lights) when no problem exists. Whether the MIL is false or not cannot be determined until the vehicle is checked by a trained mechanic. Conversely, increased ethanol levels in the fuel could prevent MILs from activating when real problems exist.

A report examining the effects of E10 versus E0 and extrapolating the data to E15 & E20 is complete and published. A subsequent assessment using state inspection and maintenance data to determine the potential for mid-level ethanol blends to trigger false MILs also is complete and published. Both reports are publicly available from CRC. These studies showed the need for additional work, and a program to look at individual vehicles is underway and should be completed in 2011.

Evaporative Emissions

This program studies the effects of mid-level ethanol blends on evaporative emissions control system durability. The program is underway and will be completed in 2012. The evaporative emissions system keeps fuel in the car from evaporating into the atmosphere and negatively impacting air quality. A previous test program found that ethanol affected fuel vapor migration through system components. The 2007 Energy Independence and Security Act required this kind of evaporative emissions durability study as a condition for issuing a waiver. We believe EPA did not fulfill this requirement.

As mentioned earlier, the DOE Catalyst Durability Study was designed to determine E15 effects on catalytic converters. Instead of waiting for the CRC test results from the above programs, EPA improperly used data from the DOE Catalyst Durability program to draw conclusions about E15 related to certain effects for which the DOE Catalyst Durability program clearly was not designed to evaluate. These include, for example, engine durability, vehicle fuel system compatibility and durability, On-Board Diagnostics impacts, and evaporative emissions durability—all areas for which the DOE testing was not designed to provide meaningful results. The CRC research programs in these areas use test procedures that are more realistic for determining the long-term effects of mid-level ethanol blends.

In addition, EPA granted "partial" waivers where some of the vehicles in the fleet can use the higher ethanol blend but not other highway vehicles, motorcycles, larger trucks, or non-road engines. Specifically, only 2001 and newer model year vehicles are eligible to use E15. Therefore, 2000 and older model year vehicles and other highway vehicles, motorcycles, larger trucks, or non-road engines cannot use E15. By granting "partial" waivers, EPA recognized the issues related to using this fuel. API has serious concerns that EPA's label and misfueling mitigation strategy is premature and should not have been finalized until all vehicle and infrastructure research and testing was completed. While API agrees with EPA that fuel dispensing facilities should be prohibited from selling E15 unless the dispensers at those locations are properly labeled, API continues to have concerns with EPA's final label. Because EPA weakened the final label design from what it originally proposed, the final design is more likely to confuse consumers about which fuels are appropriate for their vehicles and non-road equipment.

Infrastructure Research—Overview:

US worker and public safety laws require critical safety devices used at retail stations to be proven safe via a certification process by a Nationally Recognized Testing Laboratory and proven compatible via the material compatibility requirements of EPA OUST rules. In 2009, to address the potential need to raise the level of ethanol in gasoline, DOE's National Renewable Energy Laboratory (NREL) and Oak Ridge

National Laboratory (ORNL) began testing fuel retail station equipment and materials to determine how the most common equipment sold and used in the existing infrastructure would perform with E15. API also undertook research to test other equipment not covered by the DOE study. NREL contracted with Underwriters Laboratories (UL) to perform functionality testing on legacy and new fuel dispensers (i.e., the gas pump), Stage II vapor recovery systems that recover the gasoline fumes during a vehicles' refueling, and the pumps that are submerged in the underground storage tank. ORNL concentrated on the compatibility of E15 with various materials used to build the pumps (e.g., elastomers, metals and sealant materials). Late in 2010, UL released the results of their work for NREL and, in March 2011, ORNL released their report.

The results of NREL's research indicated that 70% of the used equipment tested and 40% of the new equipment tested yielded non-compliant or inconclusive test results. For example, the meters that measure the amount of fuel being pumped leaked and some of the safety devices that prevent refueling accidents didn't work. API concluded that these results show that there are potentially serious safety concerns for consumers and fuel dispensing facility attendants from dispensing E15 from any equipment that is not specifically listed for its use.

ORNL's testing showed that seals and gaskets will be impacted the most by the switch to E15 and may eventually develop leaks. However, since ORNL did not identify manufacturers with its results, it will be difficult for owners/operators of fuel dispensing facilities to determine if replacement is necessary. This is compounded by the long life of dispenser systems and the wide variety of seals and gaskets used by manufacturers. Therefore, the results of the ORNL report are of use to owner/operators of fuel dispensing facilities only to the extent that manufacturers will advise owners/operators of necessary replacements and make materials decisions in the future. ORNL's testing results did confirm those of NREL that it is not appropriate to assume that E10 equipment is safe to use with E15.

EPA's Office of Underground Storage Tanks (OUST) is focusing on developing protocols to test automatic tank gauges, which are used as the most common method of leak detection, with E10+ and is in the final stages of this development. Future OUST testing and test protocol development for other leak detection systems are contingent on future funding. Without the use of these test protocols and confirmation that any new equipment works with E15, retail station operators will not know if UST's storing E15 are leaking. API has completed two projects (misfueling mitigation measures to address consumer misfueling and a literature review to determine the ability of flame arresters to work with ethanol) and continues a third (functionality testing of Stage I Vapor Recovery equipment and overfill prevention equipment). The Stage I equipment captures the gasoline fumes that would come out of the tank during a delivery of gasoline to the station thus protecting the air and the overfill prevention equipment keeps the tank from being overfilled during the delivery protecting the delivery driver and the underground water sources. API's testing is due to be completed in second quarter of this year. The results will provide data on how well the Stage I and overfill prevention equipment function with E15.

EPA recently released their final guidance on how to determine the compatibility of an underground storage tank (UST) system with the fuel placed in it. The guidelines were intended to provide an alternative approach to prove that an installed UST system is compatible with a fuel that it was not originally certified to store or dispense. However, EPA's new approach does not provide equivalent safety and environmental protection to the original certification because EPA has equated an individual manufacturer's mere claim of compatibility with the certification that is granted from a nationally recognized testing laboratory (NRTL), like UL. If EPA had required manufacturers to provide empirical data on the compatibility of their systems that is substantially similar to the NRTL data, then EPA would have provided equivalent safety and environmental protection.

The following next steps need to be undertaken to fully assess E15 compatibility with fueling infrastructure:

- NREL's testing revealed significant problems with dispenser meter systems leaking at the seals. Retrofit kits for meter systems need to be developed and listed by UL in order to avoid complete dispenser system replacement. Listed kits or replacement dispensers are required by OSHA and Fire Codes.
- A NREL report identifies concerns that the vapor space above the unblended ethanol (E97) stored in underground storage tanks is flammable. By contrast, the vapor space above gasoline is not flammable. These concerns must be addressed before E97 can be stored as a component for blending dispensers. Ad-

ditionally, no dispensing equipment (for example, blender pumps) is listed for E97.

- Copper piping/tubing was not included in ORNL's testing. Copper is included in many legacy dispenser systems (i.e., gas pumps) and some leak detection equipment. Its compatibility with E15 is unknown and untested.

The EPA should implement final guidance on UST system compatibility through notice and comment rulemaking which would offer much-needed security to UST owners and better achieve Agency objectives. The EPA should acknowledge that a certification by a NRTL is the best indicator of compatibility and safety, is required by federal and state worker and public safety laws, and an NRTL listing should be required for new equipment. However, in the case of "legacy UST system equipment," if there is no such NRTL listing available, then there should be an alternative that is equivalent to the new equipment NRTL listing. Equivalency means that the testing is sufficiently stringent to provide proof of compatibility, and a method to demonstrate safety as required by worker and public safety rules using an independent thirdparty testing lab or a manufacturer's self-certification of compatibility that is substantiated with appropriate data similar to that used by an NRTL to make such a finding. "Legacy UST system equipment" is defined as retail gasoline station UST system equipment that has been manufactured, installed, or purchased for which a NRTL listing is not available for the fuel that is intended to be stored for resale.

Summary

The auto and oil industries' primary concern regarding an E15 waiver is the overriding need for consumer satisfaction and safety. EPA's desire to allow more ethanol to be used in conventional vehicles cannot be allowed to harm the investments made by our customers in safe, reliable, and economical vehicle transportation. The oil and auto industries cannot support a premature action that could put consumer satisfaction and safety at risk. If consumer satisfaction and safety are compromised, the credibility of not only future ethanol products but the entire RFS2 program will be questioned and challenged. That is why API is supporting a comprehensive auto/oil industry test program through the CRC to determine the effect of mid-level blends on our customers' gasoline-powered vehicles, and this testing has revealed reasons for concern. Important parts of this research program remain incomplete but we are seeing results that demand completion before E15 should be given a green light.

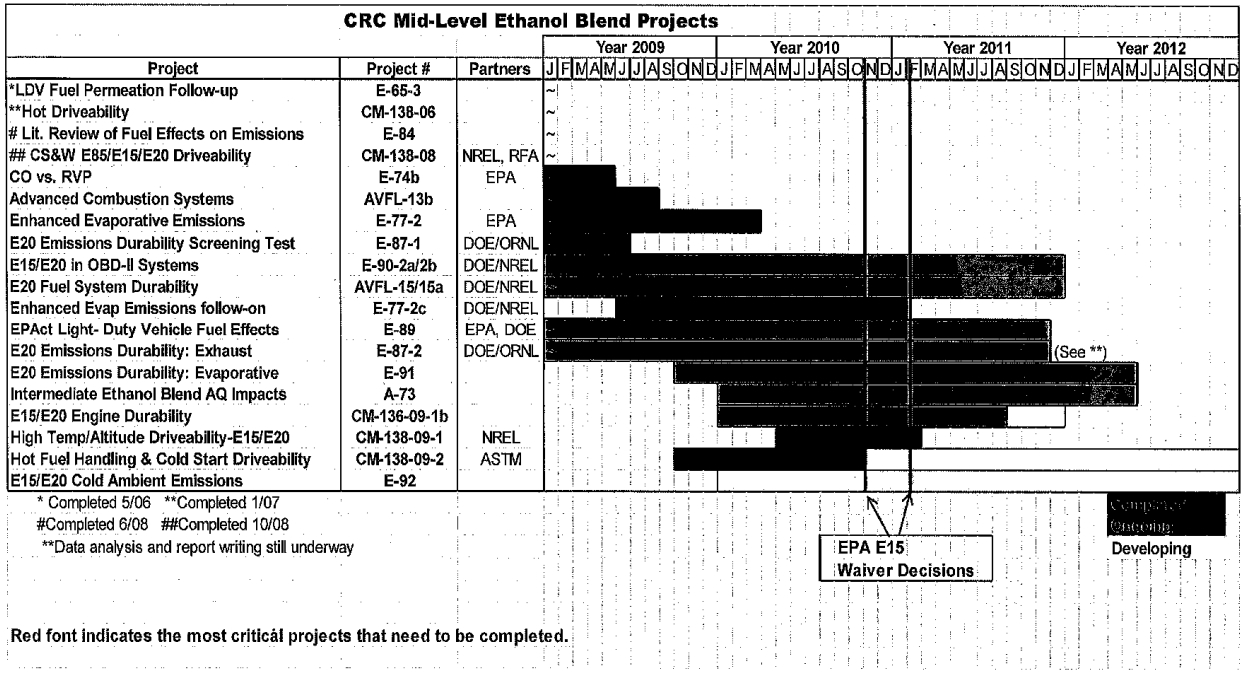
The E15 waiver controversy points to the larger problem with the RFS2 mandates. The amount of biofuels required to be blended is fast approaching the limit of the current vehicle fleet to safely utilize them. Within the next year or so this "blend wall" will be exceeded, and refiners are greatly concerned about complying with an unworkable mandate. API urges Congress to seriously examine this looming issue, and adjust the biofuels mandates so that the biofuels volumes are aligned with the vehicle fleet's capacity to safely utilize them. A premature E15 waiver is not the solution.

Finally, regarding the current fuels retail infrastructure, current federal, state and local regulations and fire codes can and do preclude the use of ethanol blends over 10 percent. Concerns regarding the listing requirements for existing infrastructure as well as this infrastructure's compatibility with ethanol blends over 10 percent should have been resolved before a mid-level ethanol waiver was granted. Not only does the use of unlisted and incompatible equipment represent a significant potential legal liability for retail station owners, it also represents an even larger safety issue as most fuel storage and dispensing equipment have not been properly tested with mid-level blends, putting consumers and the environmentat risk. And using existing infrastructure for blends over 10 percent is a violation of worker and public safety laws in OSHA and fire codes. In this regard, EPA should engage with OSHA to understand the full scale of the issues in protecting the worker, the consumer and the environment.

API remains committed to working with the auto industry and other stakeholders on E15 research until sufficient research has been completed to validate the introduction of this new fuel. EPA's partial waiver approval was premature as EPA did not wait until the ongoing research effort was finished and the results were thoroughly evaluated. The oil industry needs a level of confidence in the data that will allow our brands to stand behind a new fuel. Our customers expect nothing less.

Attachment 1

EPA's Decisions Preceded Completion of Needed Research



Red font indicates the most critical projects that need to be completed.

Attachment 2

Engine Durability Testing Status to Date

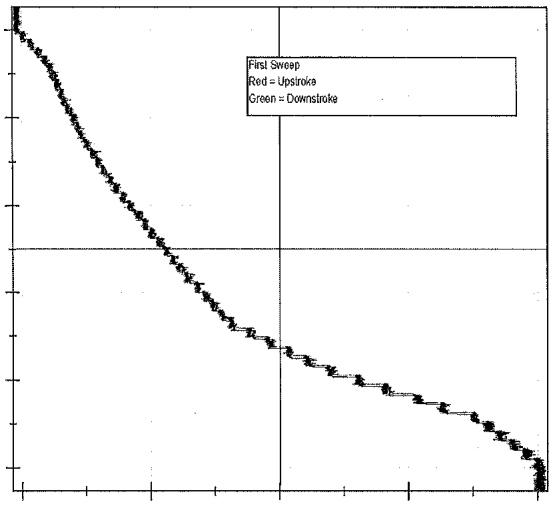
- Engines are tested for 500 hour aging cycles and engine conditions monitored throughout (e.g., cylinder compression, valve wear, valve leakage, etc.)
- Vehicles are then tested to determine if there are any changes including emissions.
- Engines failing on E20 are then tested on E15 and then E0 to isolate the effects to ethanol

Description	E20	E15	E0
Vehicle 1			
Vehicle 2	Failed	Failed	Underway
Vehicle 3			
Vehicle 4			
Vehicle 5			
Vehicle 6	Completed	TBD	TBD
Vehicle 7			
Vehicle 8			Planned

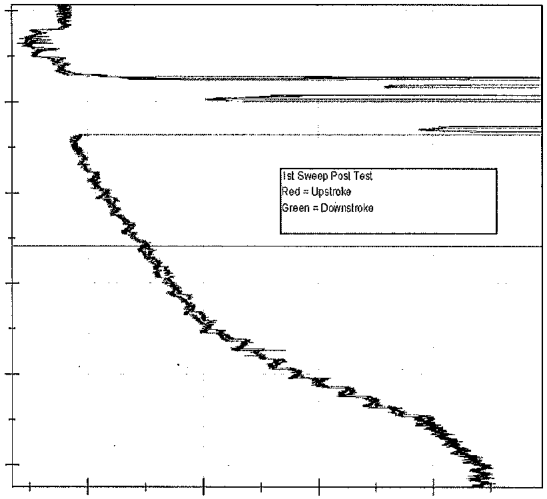
* 1st of 2 vehicles. 2nd vehicle still under test.

Attachment 3

Fuel System Durability Testing Status to Date -- Fuel Level Sender Resistance Testing



Pre-Test



Post- Test E20A

NOTE: This is an example of a fuel level sender which experienced a significant open circuit near the full/top position with E20A. This would result in erratic/false fuel gauge readings for the consumer and create potential safety problems.

Chairman HARRIS. Thank you very much, Mr. Greco. Ms. White?

STATEMENT OF MS. HEATHER WHITE, CHIEF OF STAFF AND GENERAL COUNSEL, ENVIRONMENTAL WORKING GROUP

Ms. WHITE. Chairman Harris, Ranking Member Miller and Members of the Committee, my name is Heather White. I am chief of staff and general counsel to Environmental Working Group, a nonprofit research and advocacy organization based here in Washington, with offices in Iowa and California. Thank you for the opportunity to testify at this important hearing.

Mr. Chairman, today the corn ethanol industry enjoys the luxury of a lucrative market created almost entirely by government intervention at taxpayer expense. Corn producers and ethanol companies press in tandem for any government intervention, especially from Washington. That will, by expanding the market for corn ethanol, automatically expand the market to deal with our oversupply of corn, an oversupply that was created in part by USDA crop subsidies, price and income supports. That is what this E15 debate is about, not energy policy or energy independence.

We believe the government should play a strong leadership and regulatory role in shaping the Nation's energy future. But making additional market distorting commitments to corn ethanol is not the way to get there. Adding small, well-tested amounts of ethanol as an engine fuel additive to reduce air pollution in targeted areas makes sense. But corn ethanol is not an alternative transportation fuel.

Mandating higher blends will increase air pollution. Corn requires more pesticides and fertilizers than other crops. Sky-high corn prices have already resulted in fence-row-to-fence-row planting. That depletes the soil, pollutes water, causes drastic soil losses. On top of that, imagine the consumer nightmare of E15 when people use the wrong gas, damage their car or truck, lawnmowers or boats, and realize their warranties are no good.

Our comprehensive review of the current science concludes that the data do not support a decision to waive the Clean Air Act for E15. Higher ethanol blends lead to more toxic air pollution, lower gas mileage, more leaks from underground storage tanks, greater potential for drinking water contamination and damage to older cars and trucks and small engines.

We believe in a strong, vibrant, well-funded EPA and robust authority for the Administrator, and the majority of the time, we are on EPA's side. This Agency protects our public health and has saved billions of dollars in healthcare costs through environmental enforcement and regulation. But we think this decision is a bad call. It asks Americans to play roulette at the gas station if they fill an unapproved vehicle with E15.

Earlier this year we asked 13 car makers whether vehicles made after 2001 could use E15 and whether the warranty would cover engine damage related to E15. The answer for most companies was either no, the warranty won't cover you or we don't know. Congressman Sensenbrenner received similar responses recently when he did his own survey of automakers.

Crowning corn ethanol the energy winner is unfair to real, clean energy technologies. In additional to corn subsidies, the industry

benefits from the ethanol blender's tax credit, an import tariff, and mandated production under the renewable fuel standard. These subsidies are crowing out the market for more promising advanced biofuels. Remember in 2007 when Congress was told that the renewable fuel standard would set up corn ethanol as a bridge to better advanced biofuels? Corn ethanol has since exceeded its mandate, but EPA has lowered advanced biofuel production targets by 90 percent. In fact, corn ethanol is a bridge to nowhere.

In industry's response to its broken promises is to task for even more government handouts. In the face of an overwhelming Senate vote to end the blender's tax credit, its latest ploy is to get taxpayers to pay for special gasoline blender pumps that can handle various ethanol blends. But wasting more money on corn ethanol will only lock in this environmentally unsustainable fuel while locking out alternatives, among them drop-in fuels such as those made from switchgrass, wood, crop residues and algae that do not require special pumps.

In conclusion, EWG supports, one, efforts to reduce overall gasoline consumption through fuel efficiency and mass transit; two, biofuels, especially drop-in fuels that use existing infrastructure, conserve soil, water, air and wildlife habitat, do not compete with the food supply and do not divert farmland from food production; and finally, the Committee's draft language calling for a National Academy of Sciences study on mid-level ethanol blends. We need greater scientific certainty before we move forward and introduce this fuel into our Nation's fuel supply.

Thank you. I welcome the opportunity to answer any questions you may have.

[The prepared statement of Ms. White follows:]

PREPARED STATEMENT OF MS. HEATHER WHITE, CHIEF OF STAFF AND GENERAL COUNSEL, ENVIRONMENTAL WORKING GROUP

Chairman Harris, Ranking Member Miller and distinguished Members of the Committee: My name is Heather White. I am chief of staff and general counsel at the Environmental Working Group, a nonprofit research and advocacy organization based in Washington, DC, with offices in Ames, Iowa, and Oakland, California. I thank the Members of the Committee for holding this important hearing and for the opportunity to testify.

For almost two decades, our organization has advocated protection of vulnerable people from toxic contaminants, ending subsidies that encourage environmental harm and investing instead in conservation and sustainable development.

This nation's biofuels policy is on the wrong path. Environmental Working Group believes that the Environmental Protection Agency should not have waived the federal Clean Air Act to allow the percentage of ethanol blended with gasoline to increase by 50 percent, to 15 percent ethanol. Until this decision, gasoline's ethanol content was generally capped at 10 percent. We are nearing the "blend wall," the maximum amount of ethanol that can legally be blended into fuel. This blend wall is potentially at odds with the production mandate of 36 billion gallons of biofuels set forth in the Renewable Fuels Standard of the 2007 energy bill. Because of the lack of enforceable environmental safeguards surrounding biofuels policy, we opposed expansion of the energy bill's RFS mandate.

As this subcommittee examines mid-level ethanol blends and ethanol policy from a scientific perspective, we urge you to support efforts to:

(1) Allow the ethanol tax credit to expire in 2011 and eliminate other oil subsidies and tax breaks.

(2) Reject corn ethanol industry proposals to fund grants and back loan guarantees to support conventional biofuels infrastructure such as blender pumps, corn ethanol pipelines and mandates for flex-fuel vehicles.

(3) Invest in focused research on advanced biofuels, including those recommended by the Interagency Biofuels Task Force, that significantly reduce greenhouse gases,

do not compete with or displace food crops and are environmentally sustainable over both the short and long-term.

(4) Reform the Renewable Fuels Standard by freezing and phasing out conventional biofuels mandates and adding significant and enforceable environmental safeguards to the advanced biofuels mandate.

(5) Focus on policies that would cut gasoline consumption, among them, encouraging drivers to make fewer trips, to carpool and to invest in vehicles or forms of transportation that actually reduce dependence on fossil fuels.

No matter which path Congress takes on biofuels policy, it is clear that the latest science on the health risks of mid-level ethanol blends raises red flags. Our comprehensive review of the available scientific data indicates that E15 and higher ethanol blends could have significant adverse impacts on human and environmental health. (Appendix A). The data simply do not support a decision to approve fuel blends above E10 in the U.S.

Furthermore, E15-blended gasoline will likely result in a consumer nightmare for small engine owners, boaters and owners of older vehicles, who may find their engines destroyed or damaged and their warranties void. Until these data are adequately generated and assessed, consumer safety, public health, and environmental protection are at risk from mid-level ethanol blends.

Hitting the blend wall is symptomatic of our backwards biofuels policy, but, in fact, for the last 30 years, federal subsidies and other supports for biofuels have been misguided. Federal supports for corn ethanol, an environmentally destructive biofuel, are numerous and duplicative.

The ethanol industry benefits from corn subsidies since corn is its main feedstock. The industry also receives ethanol blender's tax credit, import tariff and mandated production through the Renewable Fuel Standard. These taxpayer-backed subsidies for corn ethanol are crowding out the market for more promising advanced biofuels. It is time we stopped subsidizing corn ethanol and artificially stimulating demand for ethanol blends that are not compatible with many vehicles and engines.

Some recent actions by the Environmental Protection Agency are cases in point.

- In March 2009, Growth Energy, representing 54 ethanol manufacturers, applied for a federal Clean Air Act waiver to increase the percentage of ethanol that can be blended into gasoline from 10 percent to 15 percent.
- On October 13, 2010, EPA approved a partial waiver, permitting E15 to be introduced into the fuel supply, with the caveat that it was approved only for vehicles manufactured after 2006. EPA proposed a rule to avert misfueling, meaning, using E15 in pre-2006 vehicles. It contemplated labeling gasoline pumps to deter consumers from fueling incompatible engines with E15.
- On January 21, EPA extended the E15 waiver to vehicles manufactured as early as 2001, effectively approving the higher ethanol blend for use in about two-thirds of the U.S. vehicle fleet.
- On June 28, EPA published its final misfueling rule, with label language intended to warn consumers if their vehicle or engine could be damaged by E15.[1]

Problems with higher blends of ethanol

The Environmental Protection Agency's decision to approve E15 is bad for consumers, the environment and public health. The decision is counterproductive to the national goal of reducing gasoline consumption and strengthening energy independence. Expanding gasoline's ethanol content by 50 percent will result in numerous short-term and long-term problems, among them:

- Consumer confusion at the pump
- Damage to older cars and trucks[2]
- Damage to small and off-road engines[3]

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[1] U.S. Environmental Protection Agency. "E15 (a blend of gasoline and up to 15% ethanol)" 23 June 2011. Accessed 4 July 2011 at http://www.epa.gov/otaq/regs/fuels/additive/e15/.

[2] U.S. Environmental Protection Agency. 2009. Written Statement by Margo T. Oge, Director, Office of Transportation And Air Quality, Office Of Air And Radiation, U.S. Environmental Protection Agency to the Committee on Environment and Public Works, Subcommittee On Clean Air And Nuclear Safety, United States Senate. Accessed online 1 April 2009 at http://epw.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing__ID=3fdd18ff-802a-23ad-4378-d21b6beb4d5a.

[3] Knoll, K., West, B.H., Clark, W., Graves, R.L., Orban, J., Przesmitzki, S., Theiss, T.J., Knoll, K., West, B.H., Clark, W., Graves, R.L., Orban, J., Przesmitzki, S., and Theiss, T.J. "Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1— Updated." Department of Energy. 2009. Accessed online 6 March 2009 at http://feerc.ornl.gov/publications/Int__blends__Rpt1__Updated.pdf.

- Safety issues [4]
- Voided engine warranties
- More air pollutants like nitrous oxide and formaldehyde [5]
- More leaks from underground storage tanks [6]
- Greater potential for drinking water contamination

Preventing misfueling

EPA approved introduction of E15 into the fuel supply with conditions that aimed to help consumers avoid using it in older vehicles and small engines. The agency:

- Prohibited blends between E10 and E15 in unapproved vehicles and engines.
- Require all fuel dispensers to have a label if a retail station chooses to sell E15.
- Required a national survey of retail stations to ensure compliance with the labeling provisions. [7]

EWG recommended that the EPA require gasoline station owners to put clear, detailed labels on pumps in order to alert consumers to the dangers of E15. [8] EPA incorporated a few of our recommendations but watered down the language at key points. For instance, we suggested the label bear the word "Warning." EPA opted for the weaker word "Attention." We recommended that the label display an 800 number and website address or that it advise the consumer to consult the owner's manual if uncertain whether E15 could be used in a particular vehicle or small engine. EPA ignored these suggestions, among many others, that would help prevent harm to older vehicles and ethanol-related pollution.

EPA's final rule minimized safety issues. It did not adequately inform consumers that small engines can stall or fail if fueled wrongly with E15.

Taken together, these EPA decisions do not adequately protect consumers, public health or the environment.

EPA decisions endanger older and smaller engines

Adding small, well-tested amounts of oxygenated additives like ethanol to engine fuel to reduce air pollution in targeted nonattainment areas makes sense. But the misguided effort to treat ethanol as an alternative transportation fuel has become a well-founded source of concern for consumers, environmental groups, livestock farmers, automobile makers and the food industry. Most gasoline sold in the U.S. contains 10 percent ethanol. Most engines can tolerate that much ethanol. But engines run hotter on a gasoline-ethanol blend than on pure gasoline. As a result, many gasoline engines cannot run on E15 without risking major internal damage and increased tailpipe emissions. Newer vehicles can accommodate increased exhaust and catalyst temperatures, but many older vehicles cannot. For that reason, EPA has approved E15 only for automobiles made in 2001 and thereafter. Yet the ethanol industry, thirsting for bigger markets and more sales, has pressed hard to add E15 to the entire automobile fuel supply, arguing without basis that increased ethanol content in gasoline would somehow foster American energy independence. Well-known compatibility problems suffered by older vehicles and small or off-road engines were pushed to the side.

Growth Energy has contended that tests show that no problems exist with using the E15 fuel mix. It has urged the agency to extend the waiver to older vehicles. [9]

In fact, the Department of Energy's vehicle emissions data for 2001 to 2006 model vehicles found that four of eight vehicles failed to meet at least one of three emissions standards, for nitrous oxide, carbon monoxide and non-methane organic

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[4] Naidenko, Olga. "Ethanol-Gasoline Fuel Blends May Cause Human Health Risks and Engine Issues." May 2009. Accessed online 4 July 2011 at http://www.ewg.org/biofuels/report/Ethanol-Health-Risks-and-Engine- Damage.

[5] U.S. Environmental Protection Agency. "National Air Quality—Status and Trends through 2007 EPA-454/R- 08-006." 2008. Accessed online May 2009 at http://www.epa.gov/airtrends/2008/index.html.Lower gas mileage.

[6] Tiemann, Mary. "Leaking Underground Storage Tanks: Prevention and Cleanup." 18 May 2010. Congressional Research Service. Accessed online 4 July 2011 at http://ncseonline.org/nle/crs/abstract.cfm?NLEid=1457.

[7] U.S. Environmental Protection Agency. "EPA Announces E15 Partial Waiver Decision and Fuel Pump Labeling Proposal." 2 December 2010. Accessed online 4 July 2011 at http://www.epa.gov/otaq/regs/fuels/additive/e15/420f10054.htm.

[8] Environmental Working Group. "Comments on EPA's E15 Misfueling Rule (40 CFR Part 80 on November 4, 2010)." Accessed online 4 July 2011 at http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore—id=b33e540b-d305-4ba6-be45-81a0d701ed2b.

[9] Growth Energy. "In Landmark Move, EPA Approves Higher Ethanol Blend for Vehicles Built in Last Decade." 21 January 2011. Accessed online 4 July 2011 at http://www.growthenergy.org/news-mediacenter/ releases/-in-landmark-move-epa-approves-higher-ethanol-blend-for-vehicles-built-in-last-decade/.

gases. [10] Vehicles newer than 2006 fared slightly better. Still, fully one-fifth of vehicles manufactured in 2007 or later failed to meet at least one emissions standard when using E15.

The E15 waiver is based on Section 211(c)(1), a provision in the federal Clean Air Act that allows the EPA to issue regulations to "control or prohibit the manufacture, introduction into commerce, offering for sale, or sale of any fuel or fuel additive for use in a motor vehicle, motor vehicle engine, or nonroad engine or nonroad vehicle (A) if, in the judgment of the Administrator, any fuel or fuel additive or any emission product of such fuel or fuel additive causes, or contributes, to air pollution or water pollution (including any degradation in the quality of groundwater) that may reasonably be anticipated to endanger the public health or welfare, or (B) if emission products of such fuel or fuel additive will impair to a significant degree the performance of any emission control device or system which is in general use, or which the Administrator finds has been developed to a point where in a reasonable time it would be in general use were such regulation to be promulgated." [11]

It appears that EPA considered only option B when approving the E15 waiver. It seems to have ignored the act's first principle—to protect public health and welfare. The agency approved a fuel known to damage vehicle engines made before 2001 and with some chance of causing newer vehicles to emit excessive pollutants. In its final misfueling rule, EPA admitted that E15 use "could lead to extremely elevated exhaust and evaporative emissions." [12] EPA issued the waiver despite evidence of increased emissions with use of higher ethanol blends. The waiver directly conflicts with testing by the Department of Energy, the National Renewable Energy Laboratory, the Oak Ridge National Laboratory and the Coordinating Research Council, a non-profit organization that conducts engineering and environmental studies on the engines and petroleum products. [13]

Health hazards of E15 emissions

EPA's E15 decision presents a clear risk to human health. [14] The more a vehicle burns higher ethanol blends, the more it emits the toxic pollutants acetaldehyde, formaldehyde and nitrous oxide.

Last month, the Department of Health and Human Services officially classified formaldehyde as a "known human carcinogen." [15] The International Agency For Research on Cancer, an arm of the World Health Organization, also uses that designation. As well, formaldehyde causes severe respiratory tract irritation, chronic bronchitis and airway inflammation. [16]

Acetaldehyde is a strong respiratory irritant and toxicant that is especially dangerous to children and adults with asthma. [17] EPA considers acetaldehyde a probable human carcinogen, based on studies in laboratory animals and in exposed workers. [18]

Higher concentrations of acetaldehyde in car emissions could lead to increased cancer incidence and greater prevalence of respiratory disorders.

Nitrous oxide emissions aggravate asthma, airway inflammation and respiratory disease. [19] Nitrous oxide contributes to the formation of ground-level ozone, a res-

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[10] Environmental Working Group. "When It Comes to E15, Never Mind the Data." 5 May 2011. Accessed online 4 July 2011 at http://www.ewg.org/agmag/2011/05/when-it-comes-to-e15-never-mind-the-data/.

[11] U.S. Environmental Protection Agency. "Regulation To Mitigate the Misfueling of Vehicles and Engines With Gasoline Containing Greater Than Ten Volume Percent Ethanol and Modifications to the Reformulated and Conventional Gasoline Programs." 23 June 2011. Accessed online 4 July 2007 at http://www.epa.gov/otaq/regs/fuels/additive/e15/mitigate-misfuel-e15.pdf.

[12] Ibid.

[13] Coordinating Research Council, Inc. "About CRC." Accessed online 4 July 2011 at http://www.crcao.com/about/index.html.

[14] U.S. Environmental Protection Agency. "Health Effects Notebook for Hazardous Air Pollutants." 2007. Accessed online 17 March 2009 at http://www.epa.gov/ttn/atw/hlthef/hapindex.html.

[15] National Institutes of Health—National Toxicology Program. "Formaldehyde." June 2011. Accessed online 4 July 2011 at http://www.niehs.nih.gov/about/materials/formaldehydefs.pdf.

[16] U.S. Environmental Protection Agency. "Health Effects Notebook for Hazardous Air Pollutants." 2007. Accessed online 4 July 2011 at http://www.epa.gov/ttn/atw/hlthef/hapindex.html.

[17] McCarthy, MC, O'Brien, TE, Charrier, JG, and Hafner, HR. "Characterization of the Chronic Risk and Hazard of Hazardous Air Pollutants in the United States Using Ambient Monitoring Data." 2009. Environmental Health Perspectives 117(5): pp. 790-96; see also U.S. Environmental Protection Agency. 1991. Integrated Risk Assessment System (IRIS). Acetaldehyde (CASRN 75-07-0). Available: http://www.epa.gov/iris/subst/0290.htm.

[18] U.S. Environmental Protection Agency. "Acetaldehyde." 6 November 2007. Accessed online 4 July 2011 at http://www.epa.gov/ttnatw01/hlthef/acetalde.html.

[19] Weinmayr G, Romeo E, De Sario M, Weiland SK, Forastiere F. 2010. Short-term effects of PM10 and NO2 on respiratory health among children with asthma or asthma-like symptoms: a systematic review and meta-analysis. Environ Health Perspect 118(4): 449-57.

piratory toxicant; it is also associated with acid rain as well as with harmful effects on soils and surface waters. [20]

Misfueling explained

EPA's final rule on misfueling, issued June 27, is aimed at mitigating damage that a fuel like E15 can inflict upon unapproved engines like older cars and trucks and small or off-road engines. EPA's misfueling rule will require gasoline stations to place approved labels on pumps and take other measures to help consumers choose the correct fuel blends for their vehicles or equipment. This rule will not, in fact, avert widespread misfueling and resulting engine warranty problems and needless expense incurred by vehicle owners. The label EPA has designed for gasoline pumps is not sufficient to alert consumers to the hazards of misfueling. EPA has given little guidance as to who, if anyone, will be held responsible when a motorist fills an unapproved vehicle or engine with E15.

Earlier this year, Environmental Working Group called the national headquarters of 13 automobile manufacturers and asked two simple questions:

1. Could vehicles from model years 2001 and later use E15 if it were to come on the market over the next year or so?

2. Would the company's warranty be voided if a vehicle had engine trouble related to E15?

Not a single automobile manufacturer provided detailed answers to our questions. [21] Four said that engine problems caused by E15 would void their warranties. Most companies passed the buck, recommending that we ask a local dealer or check back later. Four suggested using a high-octane (and more expensive) blend. Only Chevrolet said its warranty would not be voided by E15-related damage if the correct octane level had been used.

Small engines such as lawnmowers, outboard motors and chainsaws are even more vulnerable to E15-related damage because they were not manufactured to run on higher ethanol blends. The small engine industry has petitioned EPA to ensure that E10 will still be available. EPA denied this request last week.

In the end, it seems that consumers, convenience store owners, car companies, local dealers and small engine manufacturers will be on their own to sort out the risks of E15.

Leaking underground storage tanks

In its recent guidance, EPA has reported that ethanol is more corrosive than gasoline and can cause underground gasoline storage tanks to leak. We suggested that EPA determine the implications of storing higher blends of ethanol in these tanks. Since researchers have established that storing gasoline-ethanol blends in incompatible tanks can cause leaks, EPA should assess the increased risk of soil and water contamination before it allows E15 to be introduced. We thank this Committee for taking leadership on this important issue.

Biofuels policy on wrong track

The many uncertainties surrounding E15 are symptoms of a much larger problem. Our nation's biofuel policy is on the wrong track. The Renewable Fuel Standard, set in the 2007 energy bill, calls for production of 36 billion gallons of renewable fuels by 2022. In practice, this standard does little or nothing to accomplish Congress' primary objective—to bring to market a new generation of so-called advanced biofuels that do not compete with food crops. More than 90 percent of ethanol produced in the U.S. is refined from corn. Corn ethanol production—conceived as a first-generation biofuel solution—continues to exceed the maximum production level set by the Renewable Fuel Standard mandate. At the same time, production of cellulosic biofuels has lagged. EPA has been forced to reduce mandates for them by more than 90 percent over the past two years.

The notion that the Renewable Fuel Standard set up corn ethanol as a bridge to better advanced biofuels is simply false. Corn ethanol is proving to be a bridge to nowhere.

Meanwhile, corn ethanol production consumes a disproportionate share of renewable energy tax credits. The Biomass Crop Assistance Program, an offshoot of the U.S. Department of Agriculture's Farm Service Agency that intended to facilitate

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[20] U.S. Environmental Protection Agency. "National Air Quality—Status and Trends through 2007 EPA-454/R- 08-006." 2008. Accessed online 20 January 2009 at http://www.epa.gov/airtrends/2008/index.html.

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the development of cellulosic biofuels, has veered seriously off track. Instead of funding crops like switchgrass, envisioned as a cellulosic feedstock, more than 80 percent of this program's budget has gone to existing pulp and paper companies.

This year, Congress has considered bills and amendments to limit funding for ethanol blender pumps and to repeal the Volumetric Ethanol Excise Tax Credit. EWG and at least 89 other organizations support repealing this tax credit this year.[22] We have urged Congress not to spend scarce taxpayer funds on blender pumps and other corn ethanol infrastructure. Wasting money on corn ethanol will only lock in this environmentally unsustainable fuel while locking out alternatives, among them dropin fuels—those made from switchgrass, wood and crop residues and algae—that do not require special infrastructure.

The Department of Energy has recently announced grants and loan guarantees for research and development of advanced drop-in biofuels, following 2009 recommendations of the Interagency Task Force on Biofuels.[23] Meanwhile, in April, USDA announced an interim final rule that would make ethanol blender pumps eligible for Rural Energy for America Program funding.[24] Congress created the program to fund solar, wind, hydropower and energy efficiency projects that have true potential to reduce dependence on foreign oil and create rural jobs. Funding blender pumps will accomplish neither of these goals. The taxpayers will subsidize the corn ethanol industry once again.

It is time to take a fresh look at our biofuels and transportation fuel policies. The first and immediate priority should be to reduce overall gasoline consumption by improving vehicle fuel efficiency, supporting alternative transportation opportunities and other such measures. We should follow the recommendations of the Interagency Task Force on Biofuels and focus on bringing advanced drop-in fuels to commercialization. We should undertake careful assessments of the performance of advanced biofuels before forcing them onto the market or spending large amounts of taxpayer dollars on subsidies and other incentives.

It is critical that federal policy encourage those biofuels that are compatible with existing infrastructure, that conserve soil, water, air and wildlife habitat, that do not compete with the food supply and that do not use land that is used for food production. We cannot make the same mistakes that were made with corn ethanol.

We believe that EPA's recent E15 waiver runs counter to scientific evidence that mid-level ethanol blends worsen pollution. We support the Committee's draft legislative language calling for a study by the National Academy of Sciences of the implications for public health of mid-level ethanol blends.

We thank the Committee for holding this important hearing. We look forward to working with you to ensure that E15 is not prematurely introduced into our fuel supply at the expense of consumers, the environment and public health.

[Additional information follows]

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[22] National Resources Defense Council. "Coalition of 90 Group Urges Congress to End Corn Ethanol Subsidies." 1 March 2011. Accessed online 4 July 2011 at http://switchboard.nrdc.org/blogs/slyutse/today__a__whopping__87__organizati.html.

[23] The White House. "Growing America's Fuel: An Innovation Approach to Achieving the President's Biofuels Target." 3 February 2010. Accessed online 4 July 2011 at http://www.whitehouse.gov/sites/default/files/rss__viewer/growing__americas__fuels.PDF.

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ENVIRONMENTAL WORKING GROUP www.ewg.org

Ethanol-Gasoline Fuel Blends May Cause Human Health Risks and Engine Issues

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In March 2009 corn ethanol producers asked for help from the federal government to expand their industry. Growth Energy, a consortium of ethanol producers, petitioned the Environmental Protection Agency (EPA) to allow 50% more ethanol in gasoline than is currently permitted, requesting approval for E15 fuel (a mixture of gasoline with 15% ethanol) (Growth Energy 2009).

EWG's review of available scientific data finds that such an increase in fuel ethanol content may involve multiple human health and safety hazards and a risk of increased air pollution. EPA cannot legally grant the waiver because there are far too many unresolved scientific questions about the impacts of E15 on engines, emission systems and air quality.

EWG's review has found that:

- A higher ethanol blend may damage nonroad engines and emission control systems.
- Emissions from higher ethanol fuels may worsen health risks from air pollution.
- Distribution of higher ethanol fuel blends may pose new safety risks and higher fuel costs.
- Higher-ethanol fuel blends may compromise lifetime performance of non-flex fuel vehicles.

Also in question is whether ethanol fuels reduce greenhouse gas emissions when the full life-cycle impacts of the fuel additive are considered (U.S. EPA 2009a). Numerous outstanding questions are the subject of several ongoing studies that have yet to generate a comprehensive dataset suitable for definitive scientific or regulatory assessment of blends above 10% ethanol (E10). A wide range of experts — including vehicle, engine, and equipment manufacturers; gasoline producers and refiners; EPA officials; public health experts and academics — advocate for adequate testing to answer important questions about E15's effects on engines, emission control systems and air quality (American Lung Association 2009; Bechtold 2007; Drevna 2009; National Marine Manufacturers Association (NMMA) 2009; Outdoor Power Equipment Institute (OPEI) 2009; U.S. EPA 2009a; U.S. EPA 2009b; Westerholm 2005).

The limited data available clearly indicate that nonroad engines and a sizeable number of older, still roadworthy vehicles could be damaged by increased levels of ethanol in fuel. Comprehensive scientific analysis and testing are needed before EPA will know the full extent to which E15 could damage the existing fleet of 247 million cars, trucks, and buses and 400 million non-vehicle gasoline engines (American Lung Association 2009; Drevna 2009; Outdoor Power Equipment Institute (OPEI) 2009; U.S. EPA 2009b).

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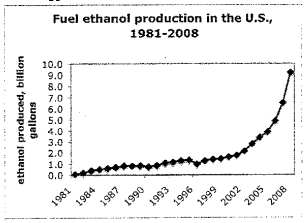
This document addresses the multiple concerns that have emerged regarding the use of intermediate ethanol blends like E15 by the current vehicle fleet and nonroad engines. These concerns include potential adverse effects of ethanol on lifetime performance of vehicle emissions control systems; elevated emissions of toxic air pollutants associated with production and combustion of ethanol; decreased fuel economy; high cost and fire safety hazard of ethanol distribution; and the impact of ethanol fuel on nonroad engines and outdoor equipment.

These issues need to be addressed and resolved in a science- and data-driven, public process before a conclusion can be reached regarding the safety and advisability of widespread use of intermediate ethanol blends, including the current E10 blend. The analysis below reviews the currently available data for each of the current health and safety concerns.

Background

The U.S. supplied 142.3 billion gallons of finished motor gasoline in 2007 and 137.8 billion gallons in 2008, according to Energy Information Administration (EIA) (EIA 2008a, b). As the number of cars on the road continues to grow, government and industry efforts to maintain or improve air quality must include lowering vehicle emissions and minimizing the release of toxic air pollutants. Since the enactment of the Clean Air Act in 1970, Congress and Environmental Protection Agency have promoted a series of air quality regulations to bring less-polluting gasoline blends to the market, resulting in measurable improvements in air quality nationwide. In order to solve the energy and environmental challenges of the 21st century, we need to preserve and expand these air quality gains and protect public health by minimizing motor vehicle-related air pollution.

Ethanol was introduced into the U.S. fuel supply in 1978 through a statutory default and without proper review by EPA. For most of the past three decades, formulators have mixed very low levels of ethanol with gasoline, contrary to the industry claim that there is a successful history of "over thirty years' experience with use of ethanol-gasoline fuel blends" (Growth Energy 2009). Only a small fraction of vehicles and equipment nationwide has been exposed to 10% ethanol (E10) fuel until recently. For example, according to statistics from Energy Information Administration, 1.6 billion gallons of fuel ethanol were produced in 2000 (EIA 2008a). If this amount of ethanol were used primarily as E10, only 12% of the 130 billion gallons gasoline sold that year would have contained ethanol (EIA 2008b). Ethanol production and fuel blending grew rapidly after 2000, increasing nearly 6-fold over the course of 8 years and reaching 9.2 billion gallons in 2008 (EIA 2008a).



Panel A: Fuel ethanol production in the U.S since 1981. Source: Energy Information Administration statistics, available at http://tonto.eia.doe.gov/dnav/pet/hist/m_epooxe_yop_nus_1A.htm.

According to Energy Information Administration and U.S. Department of Agriculture (USDA) statistics, 95% of fuel ethanol is produced from corn (EIA 2008a; USDA 2006; Yacobucci 2008).

Several factors have led to the expansion of corn ethanol production. First, MTBE, an oxygen-enhancing fuel additive (oxygenate), was banned by multiple states after it was found to contaminate groundwater. The industry substituted ethanol as an alternative source of oxygen for fuel blends. The expansion of the ethanol market was also driven by the Renewable Fuels Standard (RFS) under the Energy Policy Act of 2005 and RFS revisions under the Energy Independence and Security Act of 2007, both of which provided a major political and economic boost for corn ethanol producers. The corn ethanol industry also benefits from a 45 cent per gallon of ethanol tax credit, the Volumetric Ethanol Excise Tax Credit, which is provided for every gallon of ethanol blended with gasoline.

Effects of ethanol on lifetime performance of vehicle emission control systems

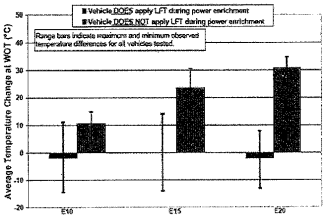
A comprehensive review of the current state of the evidence regarding the potential impact of E15 on cars and non-road engines reveals that higher blends of ethanol can degrade emission control systems and increase emissions of acetaldehyde, $PM_{2.5}$ particulate air pollution, ground-level ozone and other toxic air pollutants.

Optimal vehicle performance, durability, and emissions require an effective match among engine design, vehicle emission controls and cleaner-burning fuels. Technological breakthroughs achieved in the last decade brought to the market a new generation of low-emission vehicles able to adapt to a wide range of fuels. But older, legacy vehicles constitute a significant portion of the current fleet. These legacy vehicles cannot adjust operating conditions to accommodate a wide range of fuels, which leaves their engines and emission systems at risk from ethanol fuel blends. Early catalyst burnout and materials damage from incompatibility with ethanol fuels would likely lead to increased vehicle and non-road engine emissions and worsened air quality (American Lung Association 2009; Australian Government 2004).

In 2007 the DOE, the National Renewable Energy Laboratory (NREL) and the Oak Ridge National Laboratory initiated a test program to evaluate the impact of E15 and E20 ethanol blends on legacy vehicles and small non-road engines (Bechtold 2007; DOE 2009). The DOE data, together with the findings of an E20 study commissioned by the Australian government and published in 2004, concurred in reporting increased exhaust and catalyst temperatures associated with ethanol fuels blends, especially for older vehicles (Australian Government 2004; DOE 2009).

Modern vehicles equipped with oxygen sensor-based, closed-loop control systems are calibrated during manufacturing to appropriately compensate for higher levels of oxygen in ethanol blends. Under open-loop conditions such as wide-open throttle, increased fuel ethanol content generally leads to leaner (less fuel-rich) operation. Many newer vehicles can adjust to ethanol-blend fuel in open-loop conditions by applying a procedure called long-term fuel trim (LFT). Modern engines are calibrated to apply the same type of fuel trim in open-loop as in closed-loop conditions and thus can maintain a stable fuel/oxygen ratio. In contrast, older vehicles and even some recent models cannot perform such adjustments for higher ethanol oxygen content in fuel under open-loop conditions, resulting in hotter exhaust.

In the DOE study, 7 out of 16 vehicles tested (43%), including two 2007 model-year vehicles, ran significantly leaner during wide-open throttle as ethanol content in the fuel increased (DOE 2009). Vehicles that ran leaner during wide-open throttle compared to E0 baseline also experienced higher catalyst temperatures. Compared to E0, catalyst temperature was higher by ~10°C for E10, over 20°C higher for E15, and up to 35°C higher for E20. Increased catalyst temperatures due to ethanol blends would lead to accelerated long-term catalyst degradation, potentially causing significantly higher emissions of toxic air pollutants, the need for expensive, unplanned replacements that may fall outside of the original manufacturer's warranty, and a shorter useful life of the vehicle.



Panel B. Increase in catalyst temperature for E10, E15, and E20 fuels compared to E0 for vehicles operated at wide-open throttle (WOT) open-loop conditions. 43% of tested vehicles (red bars) experienced higher catalyst temperatures; the rest of the tested vehicles (blue bars) were able to maintain stable catalyst temperatures. Source: Figure 3.5 in the DOE (2009) report.

Information on the expected rate of catalyst degradation is not yet available. However, if the DOE findings were representative of the overall state of the vehicle fleet, a sizable fraction of the vehicles on the road would fail to maintain stable exhaust and catalyst temperatures when operated on fuels with higher ethanol content. The risk of catalyst burnout may be indicative of a potentially wide spectrum of materials incompatibility problems for ethanol fuels (Bechtold 2007; Drevna 2009). As summarized in the 2007 DOE review *Technical Issues Associated with the Use of Intermediate Ethanol Blends*, multiple studies found materials compatibility issues with E20, evidence of fuel filter obstruction even with E10, and likely impacts on driveability (Bechtold 2007). The Australian study reported that "greater levels of wear were observed for engines run with E20 than for those run with gasoline... [which] can result in compromise of the combustion system and lead to poor engine operation with resultant higher pre-catalyst emissions and increased fuel consumption" (Australian Government 2004). Widespread use of fuel with ethanol exceeding 10% could impact 100 million vehicles currently on the road that may be vulnerable to higher catalyst temperatures in wide-open throttle mode (American Lung Association 2009).

The DOE research has not yet addressed the lifetime effect of ethanol fuels on vehicle performance and emissions, leaving a data gap that must be addressed to know the extent to which ethanol blends are incompatible with the current vehicle fleet. Moreover, there has been no testing of the impact of ethanol on engines and emission control systems for vehicles that have run more than their estimated full life (120,000 miles) (American Lung Association 2009). To assess the impact of intermediate ethanol blends on the full useful life of catalyst systems, DOE is now planning an 80-vehicle study of catalyst temperature, performance, and durability (DOE 2009). As EPA recently stated in a congressional testimony, it will take at least a year for the completion of these lifetime vehicle performance studies, and it seems rational to wait for these data before approving higher

ethanol fuel blends (U.S. EPA 2009b). Other experts estimate that research to collect all the necessary data will require up to two years (Drevna 2009).

Emissions of toxic air pollutants associated with production and combustion of ethanol

Ethanol at concentrations up to 10% has served a valuable role as a fuel oxygenate, promoting more complete combustion of gasoline and reducing carbon monoxide (CO) emissions. The DOE study demonstrated a 15% reduction of CO emissions for E10 compared to E0. Of note, no further CO reduction was observed with E15 and E20; in fact, vehicles operated on E20 produced slightly higher CO emissions compared to E10 (DOE 2009). E10 also has been reported to reduce emissions of inhalation carcinogens benzene and 1,3-butadiene (Whitney 2007). However, the EPA-mandated reformulation of gasoline and introduction of better-performing engines and vehicle emission control systems resulted in reduced CO and benzene emissions for conventional, unoxygenated fuels as well (U.S. EPA 2009c). Extensive research and testing carried out by the California Environmental Protection Agency Air Resources Board confirms that there might be better alternatives than ethanol or oxygenate additives in general for reducing vehicle emissions, including CO emissions (CARB 2008). These alternatives need to be thoroughly considered so that EPA and industry can implement the most economically and environmentally sound option for reduction of CO and other air pollutants.

While oxygenated fuels have been promoted for their ability to decrease certain air toxics, multiple studies have reported higher emissions of the hazardous air pollutants acetaldehyde and formaldehyde linked to increased ethanol content in fuels (Ban-Weiss 2008; Black 1998; DOE 2009; Grosjean 2002; Whitney 2007; Winebrake 2001). Acetaldehyde and formaldehyde are probable human carcinogens (U.S. EPA 2007a). Formaldehyde is associated with respiratory tract irritation, chronic bronchitis, and airway inflammation (U.S. EPA 2007a). Acetaldehyde is a strong respiratory irritant and toxicant especially dangerous for children and adults with asthma. As demonstrated by a recent study, acetaldehyde air pollution is already above the 10^{-6} cancer risk level at most sites nationally (McCarthy 2009). Further increase in acetaldehyde could lead to increased cancer incidence and wider prevalence of respiratory problems. The table below summarizes available information on the air pollution profile of ethanol fuel blends. These data indicate that instead of providing better air quality, ethanol fuel could well result in no measurable improvement, substituting one set of air pollutants for another and possibly worsening air quality overall (American Lung Association 2009).

Air pollutant	Findings	Human and environmental health consequences
Carbon monoxide (CO)	Decreases for E10, no further improvement for E15 and E20 (DOE 2009)	Reduces the ability of blood to carry oxygen to body tissues and vital organs; aggravation of heart disease (U.S. EPA 2008)
Benzene and 1,3-butadiene	Expected to decrease due to dilution of gasoline with ethanol (E10) (Whitney 2007); no E15 data available so far	Inhalation carcinogens (U.S. EPA 2007a)
Acetaldehyde	Increases by two- to three-fold (Australian Government 2004; DOE 2009), especially when the vehicles are started at cold temperature (Whitney 2007)	Respiratory toxicant; irritant; inhalation carcinogen; strongly contributes to ground-level ozone formation (U.S. EPA 2007a)

Formaldehyde	Increases for all ethanol blends (Australian Government 2004; DOE 2009)	Respiratory toxicant; inhalation carcinogen; contributes to ground-level ozone formation (U.S. EPA 2007a)
Oxides of Nitrogen (NO_x)	Some increase for E15 (37% of vehicles in DOE study) and notable increase for E20, especially for older, high-mileage vehicles (Australian Government 2004; DOE 2009); increases for non-road engines at every ethanol concentration tested (E10, E15, and E20)	Aggravates respiratory disease; contributes to ground-level ozone formation; increases acidification and eutrofication of soil and surface water (U.S. EPA 2008)
Ethanol (precursor to acetaldehyde)	Released during both ethanol production and ethanol fuel combustion (Brady 2007; DOE 2009)	Health effects due to acetaldehyde formation in the air (U.S. EPA 2009a)
Volatile organic chemicals (VOCs)	Increased at ethanol production facilities (Brady 2007)	Respiratory toxicants; contribute to ground-level ozone formation (U.S. EPA 2007a)
Ozone	May increase with increased ethanol use due to the projected increases in VOCs and NO_x emissions (American Lung Association 2009; Jacobson 2007; U.S. EPA 2007b)	Aggravates respiratory and cardiovascular disease; higher rates of asthma; respiratory infection; increases premature death; causes damage to vegetation such as trees and crops (Jerrett 2009; NRC 2008; U.S. EPA 2008)
Particulate matter ($PM_{2.5}$)	Significant increases due to corn ethanol production compared to conventional gasoline (Hill 2009)	Aggravation of respiratory and cardiovascular disease; decreased lung function; increased asthma; premature death; nvironmental influence: impairment of visibility, effects on climate (U.S. EPA 2008)

A decision to adopt a particular fuel mix should take into consideration the full spectrum of air quality effects, including the potential air pollution from all stages of production, transportation, and combustion for the fuel. Without such a complete analysis and deliberation, it would be premature to make a determination to approve increased amounts of ethanol in fuel on the basis of partial and subjectively selected data points. As clearly demonstrated by the air quality studies above, introduction of corn ethanol could well fail to produce improvement in air quality and instead simply substitute one set of air pollutants for a different one, at a significant cost to society.

Fuel economy and cost of ethanol distribution

In addition to potentially increased vehicle emissions, ethanol blending in fuel is also associated with several hidden costs that are passed directly to consumers. Compared to gasoline, ethanol is a lower energy fuel. As a result, ethanol fuel blends are associated with a significant decrease in fuel economy, which has been observed by car owners nationwide (Learn 2009). According to DOE research, E10 has 3.6% fuel economy loss compared to E0, E15 has 5% loss, and E20 has 7.7 % loss (DOE 2009).

From the infrastructure perspective, ethanol transportation and distribution is a significant economical and technical challenge, since current pipelines cannot transport ethanol. As described in a report by the Energy Information Administration:

"Ethanol cannot be moved effectively through today's pipeline system, as it tends to get pulled into the water that usually exists in petroleum pipelines and tanks. Instead, it is blended at terminals near the end users. Splash blending, in which ethanol is added directly to a tanker truck along with the base gasoline, is commonly used. Ethanol-blended product must be kept separate from non-ethanol blends.

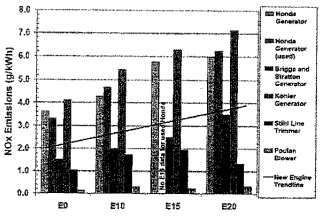
This includes separation through to the gasoline pump. The separation is needed because adding a small amount of ethanol (from the ethanol-blended mixture) to gasoline without ethanol can increase the vapor pressure of the mixture substantially, potentially pushing it above required VOC limits. Thus, ethanol will need to be moved through an independent distribution system until it is close to the end user, where it is added before being delivered to retail stations" (EIA 2002).

Since using existing pipelines is not an option, fuel ethanol can be transported only by rail or truck (EIA 2002). Currently, the majority of ethanol fuel distribution terminals are not connected to rail. Other areas are outside economic trucking distances from production plants. A recent study from Carnegie Mellon University calculated the average delivered ethanol costs, in 2005 dollars, to be in the range of $1.30–2.80 per gallon, depending on transportation distance and mode (Wakeley 2009). The study also noted that ethanol transportation would produce significant CO_2 emissions and thus lead to larger total life cycle effects. Researchers concluded that long-distance transport of ethanol, whatever the means of delivery from production sites to distribution locations, would likely negate any potential economic and environmental benefits of ethanol relative to gasoline (Wakeley 2009).

In addition to infrastructure gaps, fire safety concerns are also an issue with ethanol, since transporting and blending ethanol fuels could pose a significant fire hazard (DOT 2008; Niles 2007). Due to ethanol solubility in water, the use of water spray may be inefficient when fighting fire involving ethanol-gasoline blends mix (Missouri Department of Natural Resources 2008). Ethanol blend fuel fires cannot be readily smothered with standard fire fighting foam (Associated Press 2008; Missouri Department of Natural Resources 2008). As a result, distribution and dispensation of ethanol fuels above E10 could pose a significant fire hazard that requires specialized training and custom-made fire-fighting foams (DOT 2008; TRANSCAER 2009). Furthermore, current gasoline pumps have been developed to handle only up to 10% ethanol and are not certified by Underwriters Laboratories as safe for use with E15 (Lane 2009). While it may be possible for these pumps to handle ethanol levels up to E15, Underwriters Laboratories does not guarantee them for 1 percent more (for 16% ethanol concentration), a situation that can readily occur during splash-blending of ethanol-gasoline fuels (Jensen 2009; Piller 2009; Underwriters Laboratories 2009). Approval of E15 could pose multiple risks from potential leaks, fire hazard, involuntary accidents and other mishaps that would severely affect gas station owners and their customers (Jensen 2009).

Impact of ethanol fuel on non-road engines and outdoor equipment

Hundreds of millions of non-road engines are used across the country, including leaf blowers, line trimmers, chainsaws, lawn mowers, motor boats, generator sets, and small tractors. For many small engines, ethanol fuels could also be associated with increased emissions of hazardous air pollutants and ozone precursors such as hydrocarbons and nitrogen oxides (American Lung Association 2009; Sahu 2009). The DOE study reported that NO_x emissions increased by 50-75% for small engines operated on E10 and E15 ethanol blends (DOE 2009) compared to E0, as demonstrated by data in Panel C. Air pollution with nitrogen oxides leads to aggravation of respiratory disease and increased susceptibility to respiratory infections. NO_x also contributes to formation of ozone and particulate pollution which are associated with severe adverse respiratory effects (U.S. EPA 2008).



Panel C. Nitrogen oxide (NO_x) emissions for small non-road engines versus fuel ethanol content. Source: Figure 3.12 in the DOE (2009) report.

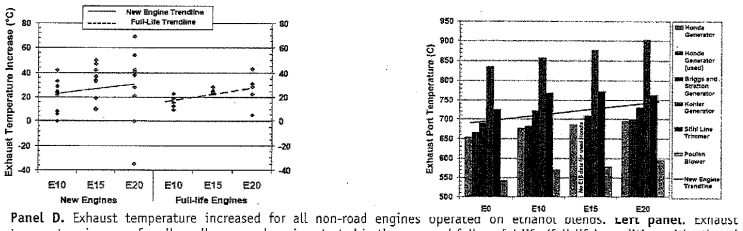
A growing body of data indicates operation of these engines on ethanol fuel blends would likely lead to both performance and safety problems. Unlike modern cars, small engines lack an oxygen sensor feedback control and are unable to compensate for higher oxygen content in ethanol-containing fuels. As a result, engines operate under "lean" or oxygen-rich conditions, which leads to engine overheating. Higher temperatures were detected for non-road engines operated on every level of ethanol in fuel (E10, E15 and E20) in the DOE study. Using an inappropriate fuel mix would impact the longevity of the engine and pose a hazard to the person operating it (Drevna 2009; Holshouser 2009; Johnson 2008; Oregon State Marine Board 2009; Outdoor Power Equipment Institute (OPEI) 2009; Williams 2008; U.S. EPA 1995).

With its initial testing of a small sample of currently sold non-road engines, the DOE study identified serious risks to the engine user (DOE 2009). In the study, three handheld trimmers demonstrated higher idle speed and experienced unintentional clutch engagement when operated on fuels with greater ethanol content. This means that small equipment could turn on spontaneously when fueled with higher ethanol blends, posing particular risks for equipment with exposed moving parts and blades like lawn mowers and chainsaws.

Small engines also experienced "missing" and "stalling" during operation on ethanol blends in DOE's study. As DOE reported:

"Small engines such as those in lawn mowers and lawn tractors, generators, line trimmers, chainsaws, and other similar equipment are open-loop engines, in that exhaust-sensing feedback is not used to control the fueling rate. Open-loop engines are commonly air-cooled and customarily operate in the fuel-rich regime to achieve cooler combustion temperatures. With a fixed fueling calibration, [increased ethanol content leads] to a higher combustion temperature and hence higher component temperatures" (DOE 2009).

The DOE detected higher exhaust temperatures for all non-road engines tested on every ethanol blend (Panel D). Relative to E0 baseline, exhaust temperatures rose by 16-42°C for E10, 19-47°C for E15 and 31-69°C for E20 (data from Table 3.13 in the DOE study).



Panel D. Exhaust temperature increased for all non-road engines operated on ethanol blends. **Left panel.** Exhaust temperature increase for all small non-road engines tested in the new and full-useful-life (full-life) condition with ethanol blends, as compared to E0 baseline. Source: Figure 3.6 in the DOE (2009) report. **Right panel.** Exhaust port temperature for pilot study engines at hottest condition versus ethanol blend level. Source: Figure 3.15 in the DOE (2009) report.

DOE detected adverse performance impacts that are consistent with multiple reports by small engine owners who observed a deleterious influence of ethanol fuels on their lawn mowers, trimmers, and motor boats (Holshouser 2009; Johnson 2008; Williams 2008). In addition to performance and safety concerns, ethanol compatibility with existing engine materials is a key issue for non-road engines (Outdoor Power Equipment Institute (OPEI) 2009). The risk is especially dire for marine engines (U.S. EPA 1995). When water gets into the fuel tank, as often happens for boats, the ethanol-gasoline mixture separates, affecting boat performance or even shutting down the engine completely (Oregon State Marine Board 2009).

In a recent statement to the Senate by the National Petrochemical & Refiners Association, National Marine Manufacturers Association and Outdoor Power Equipment Institute, a wide range of safety concerns were identified for ethanol blended fuel: higher exhaust gas temperatures; possible irreversible damage to engines; loss of durability due to incompatibility of materials; and disputes over warranty (Drevna 2009).

Finally, most small engines are fueled from regular gas stations where the distinction between ethanol-containing and ethanol-free fuel may not be readily apparent (Fuel-Testers 2009). At the present moment, small engine owners face a nearly impossible challenge of ensuring safe operation of their machines, since they often lack access to information whether they are pumping an appropriate fuel into the tank. In summary, the broad range of risks that ethanol-containing fuels may pose to small non-road engines, as revealed in available studies, does not support a decision to approve the use of intermediate ethanol blends.

Conclusion: Data gaps must be urgently addressed

The data currently available on the effects of E15 and higher ethanol blends indicate a potential for significant adverse impact on human and environmental health, and do not support a decision to

approve the use of ethanol above E10 levels in the U.S. A comprehensive assessment of ethanol fuel impacts on air quality should consider fuel compatibility with the current vehicle fleet; effects on catalyst durability, materials compatibility and driveability; and air emissions from all stages of fuel ethanol production, transportation, and combustion. As summarized by a DOE report, "the U.S. legacy fleet is too diverse to predict E15/E20 impacts from the limited available data" (Bechtold 2007). Until these data are generated and assessed, consumer safety, public health, and environmental protection may be at risk from adoption of mid-level ethanol blends.

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Chairman HARRIS. Thank you, Ms. White. Mr. Wasil?

STATEMENT OF MR. JEFF WASIL, EMISSIONS CERTIFICATION ENGINEER, EVINRUDE OUTBOARD MOTORS

Mr. WASIL. Good afternoon, Chairman Harris, Ranking Member Miller, and other Members of the Subcommittee. It is a pleasure to be here this afternoon. Good afternoon. My name is Jeff Wasil, and I am the Emissions Certification Engineer for BRP Marine Engine Division located in Sturtevant, Wisconsin. I am here today to testify on behalf of the National Marine Manufacturers Association which represents over 1,500 boat builders, marine engine and marine accessory manufacturers. I am responsible for marine engine emissions certification testing ensuring that all of our marine engines are compliant with the USEPA, California Air Resources Board and other global marine regulatory regulations. Additionally, I ensure that the engines that we sell will remain durable and perform to customers' expectations.

Over the past 12 years, I have published several peer-reviewed technical papers on marine engine emissions, including particulate matter, gaseous emissions and alternative fuels. This experience and other marine testing that I have done makes me uniquely qualified to tell you why I think it is a bad idea for the U.S. EPA to allow an increase in the volume of ethanol in gasoline and why I believe EPA has not followed proper procedures in either its decision to propose an ethanol increase in our gasoline supply or in their proposed warnings to consumers about the problems they know would be caused by E15 gasoline.

I am here today representing NMMA and my company, but in a larger sense, I am representing many different kinds of engine manufacturers, including marine, lawnmower, chain saw, snow blower and snowmobile. These types of engines that EPA refers to as non-road engines typically do not have combustion feedback sensors capable of adjusting the air-fuel ratio of the engine to meet the specific requirements of the fuel.

Ethanol is not gasoline, and the problem is that ethanol is a partially oxidized fuel, having a lower energy content than gasoline. As higher quantities of ethanol are blended into base gasoline, oxygen contained in the fuel increases for which the engine cannot compensate. Since many non-road engines do not have the capability of detecting the air-fuel requirements of the fuel, the engine could face catastrophic failure.

As the person responsible for emissions certifications, EPA requires me to design, certify and lock in with tamper-proof controls, the optimum air-fuel ratio needed to meet emission requirements.

When the fuel changes in the marketplace and additional oxygenates are added such as going to E10 to E15 gasoline, engines run hotter, causing serious durability issues and increase emissions, either in the form of increased nitrogen oxides or increased hydrocarbons due to misfire.

Last week EPA finalized the label that would be required on fuel pumps at gas stations warning consumers that using E15 in certain types of engines may damage them. NMMA believes that the language in the label is severely inadequate and will do little to

properly inform and educate consumers as to the serious consequences of using the wrong fuel.

Although NMMA and others petitioned EPA to require gas stations that offer E15 to also offer E10, EPA has denied this petition and has no plans to mandate the continued availability of E10. This will certainly lead to the very misfueling that EPA wants to avoid.

Growth energy and other ethanol proponents will say that if there is a demand for E10, the marketplace will ensure that some stations will carry it, and this may very well be true to a certain extent. However, it is very unlikely that every gas station would carry E10 which would certainly increase the likelihood of misfueling.

Now, I have seen some of the preliminary results of testing that has been conducted on marine engines by the Department of Energy. These results have not yet been made public, and we have been asked by DOE not to say anything specific until the report is final. But I can say that in these tests, the majority of engines that were run on E15 suffered significant damage or exhibited poor engine runability, performance and difficult starting, none of which is acceptable when on a boat out at sea.

I would like to end my testimony today on a positive note and mention an alternative fuel that is currently being evaluated. Last year I published a technical paper on the effects of butanol-extended fuels in marine outboard engines. Butanol has an energy content closer to that of gasoline and is not hygroscopic, meaning that it is unlikely to absorb water and phase separate like ethanol. Based on this preliminary study, the data is promising in terms of better compatibility with existing engines and fuel systems. Additionally, NMMA and others are also currently evaluating the use of butanol-extended fuels in marine products. Butanol certainly does have potential and may allow for continued use of biofuel with better compatibility with existing engines and fuel system components.

And finally, more testing should be done to determine the effects of E15 on various kinds of engines and to see whether there might be alternatives to ethanol, such as butanol. Additionally, the Committee asked me to comment on the legislation it is considering to engage the National Academy of Sciences to conduct a study of all scientific data on ethanol blends and their effects on engines. I do believe that this legislation is a good idea.

Thank you very much for allowing me to testify today.

[The prepared statement of Mr. Wasil follows:]

PREPARED STATEMENT OF MR. JEFF WASIL, EMISSIONS CERTIFICATION ENGINEER, EVINRUDE OUTBOARD MOTORS

Good afternoon, Chairman Harris, Ranking Member Miller, other Members of the Subcommittee.

It is a pleasure to be here this afternoon. My name is Jeff Wasil and I am the Emissions Certification Engineer for BRP Evinrude Marine Engine division located in Sturtevant, Wisconsin. I am here today to testify on behalf of the National Marine Manufacturers Association, which represents over 1500 boat builders, marine engine, and marine accessory manufacturers. I ask that my full written testimony, with the attached exhibits, be made a part of the record of this hearing.

I am responsible for marine engine emissions certification testing: ensuring that all of our marine engines are compliant with U.S. EPA, California, and other global

marine emission regulations. Additionally, I ensure that the engines we sell will remain durable and perform to customers' expectations. Over the past 12 years, I have published several peer-reviewed technical papers on marine engine emissions, including particulate matter, gaseous emissions, green house gas emissions and alternative fuels. This experience and other marine testing I have done makes me uniquely qualified to tell you why I think it is a bad idea for the U.S. Environmental Protection Agency to allow an increase in the volume of ethanol in gasoline and why I believe EPA has not followed proper procedures in either its decision to propose an ethanol increase in our gasoline supply or in their proposed warnings to consumers about the problems that they know would be caused by E15 gasoline.

As all of you most certainly know, EPA responded to a petition from "Growth Energy," which represents ethanol producers and supporters, by proposing to raise the percentage of ethanol in gasoline from 10 percent to 15 percent by volume. I am here today representing NMMA and my company, but in a larger sense, I am representing many different kinds of engine manufacturers—marine, lawnmower, chain saw, snow blower, snow mobile. These types of engines that EPA refers to as "nonroad engines" typically do not have combustion feedback sensors capable of adjusting the air/fuel ratio of the engine to match the specific requirements of the fuel. Ethanol is not gasoline, and the problem is that ethanol contains additional oxygen. As higher quantities of ethanol are blended into base gasoline, oxygen contained in the fuel increases, which leads to engine enleanment. Since many non-road engines do not have the capability of detecting the air/fuel ratio requirements of the fuel, the engine could face catastrophic failure. As a member of the team responsible for engine calibration, and the person responsible for emissions certifications, EPA requires me to design, certify, and lock-in with tamper-proof controls, the optimal fuel/air ratio needed to meet emission requirements. When the fuel changes in the marketplace and additional oxygenates added—such as by going from E10 gasoline to E15—engines run hotter, causing serious durability issues and increased emissions either in the form of increased Nitrogen Oxides (due to enleanment) or increased hydrocarbons (due to misfire). Additionally, ethanol is hygroscopic—meaning that it has an affinity for water. Obviously there is significant opportunity for fuel-related issues in the marine environment due to the presence of water near open vented fuel systems and due to the inherent long-term storage and usage cycles unique to recreational boats. Ethanol only exacerbates these issues.

My concern is heightened by the EPA's statutory mandate to increase the biofuel content in the nation's gasoline supply to 36 billion gallons per year by 2022 and by the EPA's efforts to achieve this mandate. As I mentioned, EPA has responded to the petition from Growth Energy by proposing a "partial waiver," allowing E15 to be used in certain vehicles and not in others. As a result of this partial waiver, EPA has begun working on a rule that will change the certification fuel for our engines from a 0% ethanol-extended fuel to a 15% ethanol-extended fuel. In addition, last week, EPA finalized a label that would be required on fuel pumps at gas stations warning consumers that using E15 in certain types of engines may damage them. NMMA believes that the language in the label is severely inadequate and will do little to properly inform and educate consumers as to the serious consequences of using the wrong fuel. I have attached a copy of the label with our specific concerns as part of my full written testimony.

The reality is that if E15 becomes the standard gasoline in the marketplace, millions of consumers will run the risk of having their vehicles, boats, lawnmowers, and other gasoline-powered devices damaged, because they will not have the option of fueling them properly. Although NMMA and others petitioned EPA to require gas stations that offer E15 to also offer ElO, EPA has denied this petition and has no plans to mandate the continued availability of ElO. This will certainly lead to the very misfueling that EPA wants to avoid.

Growth Energy and other ethanol proponents will say that if there is a demand for ElO, the marketplace will ensure that some stations will carry it, and this may be true to an extent. However, it is unlikely that every gas station would carry El0, and there might not be one anywhere near where you live or work. So that would inconvenience the consumer and increase the likelihood of misfueling.

Why have I been so insistent that increasing ethanol is almost certain to damage marine and other types of engines? As the person who works on calibrating these engines, I know first-hand how to damage them. I have seen some of the preliminary results of testing that has been conducted on such engines by the Department of Energy's National Renewable Energy laboratory. These results have not yet been made public, and we have been asked by DOE not to say anything specific until the report is final, but I can say that in these tests, the majority of the marine engines that were run on E15 suffered significant damage or exhibited poor engine runability, performance and difficult starting—none of which is acceptable when on

a boat out at sea. Why did this happen? As I mentioned in my opening, from a technical standpoint the failures are due to changes to the calibrated stoichometric air/fuel ratio requirements of E15—which is different from the fuel on which the engine was intended and designed to run. The full results of the DOE tests are scheduled to be released in the fall, but from what we have already learned, E15 will cause many engines to fail well before they should: We know that, and the EPA knows that, and it's the reason we should slow down this abrupt move to introduce E15 into the marketplace.

So that I do not end my testimony today on a completely negative point, I'd like to mention an alternative fuel that is currently being evaluated. Last year, I published a technical paper on the effects of butanol-extended fuels in marine outboard engines. Butanol has an energy content closer to that of gasoline and is not hygroscopic—meaning that it is unlikely to absorb water and phase-separate like ethanol. Based on this preliminary study, the data are promising in terms of better compatibility with existing engines and fuel systems. Additionally, the National Marine Manufacturers Association and others are also currently evaluating the use of butanol-extended fuels in marine products. Butanol, considered an advanced biofuel in the Renewable Fuels Standard (RFS), can be produced from many different types of biomass feedstocks, including corn. Recent advances in microbial fermentation processes have increased the yields of butanol, which make this product more cost-effective. We don't know for sure whether butanol is going to be a long-term viable alternative to ethanol, but it certainly does have potential. Testing is being done this summer by the NMMA and the American Boat and Yacht Council. We have also learned that other groups that make small engines are planning to test this new type of fuel. Butanol may allow for continued use of biofuel without the disadvantages of ethanol. We would like to talk with you about this when we complete our evaluation of butanol and when the DOE report on marine engines is final and we are allowed to talk more specifically about the DOE testing.

I was specifically asked by the subcommittee to comment on the draft legislation that you will be considering. This legislation calls for the National Academy of Sciences to conduct a survey of all available scientific information relating to the effects on engines of ethanol blends greater than 10 percent. This seems to me to be a terrific proposal, as it would bring together in one place all that is known about E15 and higher ethanol blends.

To summarize what I have told you today,

- First, an increase in the ethanol content of gasoline from E10 to E15 has been proposed by the EPA.
- Second, EPA acknowledges that E15 gasoline is suitable only for a limited set of gasoline powered vehicles and engines, specifically not including marine engines, snowmobile engines, engines on outdoor power equipment, and cars older than the 2001 model year.
- Third, the warning label EPA has proposed for placement on gasoline pumps is completely inadequate. The label they propose will not properly warn and inform consumers about problems associated with E15, and it is almost certain result in massive misfueling and subsequent engine damage.
- Fourth, unless continued availability of ElO gasoline is mandated by the EPA-which the EPA has declined to do-E15 will almost certainly become the common fuel in the marketplace, with ElO having very limited availability.
- Fifth, there is no need to rush E15 into the marketplace. Let's have a strategic pause while more testing is done to determine the effects of E15 on various kinds of engines and to see whether there might be alternatives to ethanol, such as butanol.

Thank you for allowing me to testify today.

Exhibit A: Jeff R. Wasil, narrative biography

Exhibit B: Press Statement, National Marine Manufacturers Association, June 28, 2011, Subject: "EPA Finalizes Pump Label and Other Misfueling Guidelines for E15; NMMA concerned controls are inadequate to prevent misfueling as final rule makes way for retail sale"

Exhibit C: Proposed EPA E15 Label, June 28, 2011

Exhibit D: Jeff R. Wasil, Justin Johnson, and Rahul Singh, "Alternative Fuel Butanol: Preliminary Investigation on Performance and Emissions of a Marine Two-stroke Direct Fuel Injection Engine"

Exhibit E: GEVO White Paper, Transportation Fuels

Exhibit F: Top Ten Reasons to use Isobutanol

JEFF R. WASIL

Jeff Wasil is currently employed as an Engineering Technical Expert, Emissions Testing, Certification and Regulatory Development at the Evinrude Product Development Center, Sturtevant, Wisc. Jeff is responsible for the marine outboard engine emissions testing and certification laboratory at Bombardier Recreation Products Evinrude Product Development Center. Jeff has twelve years experience in engine emissions testing and is intimately involved with global marine regulatory emissions development and harmonization. He is a member of the National Marine Manufacturers Association's engine manufacturers division technical board, the International Council of Marine Industry Association (ICOMIA) marine engines committee, ICOMIA technical committee and is a project leader of NMMA's greenhouse gas task force. Over the past ten years he has published and presented several technical papers on marine engine emissions including particulate matter, gaseous emissions, bioassay analysis, life-cycle emission and alternative fuels.

From 1995 to 1998 Jeff attended the Industrial Engineering Technology College of Lake County in Grayslake, IL, from which he received his Associates degree. He received a second Associates degree in "Environmental Sustainability" from Roosevelt University in Chicago.

EPA FINALIZES PUMP LABEL AND OTHER MISFUELING GUIDELINES FOR E15

NMMA concerned controls are inadequate to prevent misfueling as final rule makes way for retail sale

WASHINGTON, D.C.—June 28, 2011—Today, the Environmental Protection Agency (EPA) released its rule outlining a gas pump warning label as well as other misfueling controls for gasoline containing up to 15% ethanol, more commonly known as E15. Last October, the agency approved the use of E15 for model year 2007 and newer vehicles as part of its response to a waiver petition filed in the spring of 2009 by pro-ethanol lobby group Growth Energy. In January 2011, E15 was approved for model year 2001–2006 cars and trucks. Completion of this misfueling rule was one requirement that was stipulated in the partial waivers for E15 before the fuel could be sold at retail outlets. Fuel and fuel additive manufacturers now must register E15 with the EPA, which has not been done as of today.

While both partial waivers exclude marine engines and other non-road engines such as snowmobiles, lawn and garden equipment, the National Marine Manufacturers Association (NMMA) continues to be concerned that the measures outlined in EPA's misfueling rule do not take significant steps to address anticipated problems with consumer confusion and the risk of misfueling. In addition, the rule does not ensure compatible fuels remain available for the nation's 13 million registered boat owners or the hundreds of millions of owners of gasoline-powered equipment. These concerns were outlined in NMMA's full comments to EPA submitted earlier this year.

Specifically, NMMA is concerned that:

- **The EPA believes that misfueling will be mitigated solely through an English-only label on the gas pump.** The label does not identify the specific nature of the hazard and is not sufficiently strong enough to capture the user's attention, especially among the many existing point-of-sale labels already competing for consumers' attention. In addition, usage of the word "may" does not reflect EPA's own conclusion that E15 will damage marine engines and equipment. The label, which was not tested through consumer focus groups, does not meet American National Standards Institute (ANSI) warning label standards that require recognizable warning symbols and icons.
- **The EPA is not requiring any physical misfueling controls for E15.** NMMA recommended that physical barriers such as electronic key pad confirmation, verbal cashier confirmation, radio frequency identification (RFID) tags on E15 compatible vehicles that would lock fuel dispensers for any non-compatible use such as boats and/or the establishment of segregated pumps for E15 be required. However, the EPA is not requiring any of these highly effective physical barriers to misfueling.
- **The EPA will not conduct a consumer education campaign.**l While the agency notes that this is an important step to preventing misfueling, the agency is asking stakeholders to educate the public despite the fact that ethanol producers and corn-industry groups have aggressively marketed E15 with misleading consumer information in the past. Any fair and objective con-

sumer education campaign must be led by the EPA and not stakeholders with a direct financial incentive to promote and sell their product.

- **The EPA will not require that E10 remains available in the marketplace.** The agency has denied NMMA's petition.to require that E10 be sold at gas stations as the population of motor vehicles who are approved to use E15 grows over time. Without this requirement, fuel for boats and other nonroad engines and equipment will become an expensive specialty fuel, discouraging consumers from buying it and thus exacerbating the risk of misfueling.

"As E15 becomes available for on-road vehicles, this greatly increases the likehood of misfueling in boats, the large majority of which are refueled at neighborhood automotive gas stations where E15 will be sold," said NMMA President Thom Dammrich. "NMMA is disappointed that EPA's only mechanism to protect consumers from confusion at the pump and consequent engine failures, emissions control failures and safety issues is a small label on the pump."

In December 2010, the NMMA filed suit in the U.S. Court of Appeals for the D.C. Circuit challenging EPA's partial waiver to approve E15 for certain motor vehicles. NMMA continues to work with the Outdoor Power Equipment Institute (OPEI), the Alliance of Automobile Manufacturers (AAM) and the Association of International Automobile Manufacturers (AIAM) in a coalition called the Engine Products Group (EPG) in pursuing this legal challenge.

For more information, contact Cindy Squires at 202–737–9766 or csquires@nmma.org.

Contact: Christine Pomorski 202.737.9774

Proposed EPA E15 Label

(As of June 28, 2011)

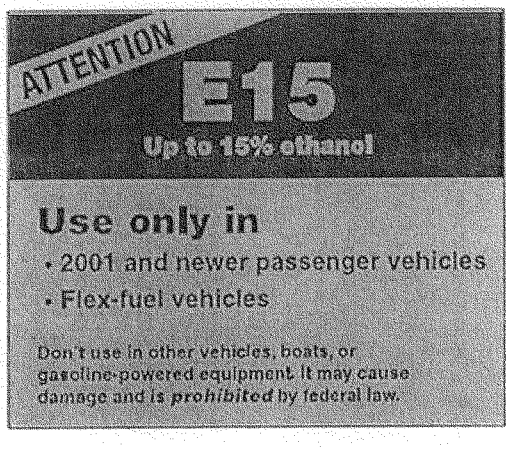


Exhibit C

2010-32-0054 / 20109054

Alternative Fuel Butanol: Preliminary Investigation on Performance and Emissions of a Marine Two-Stroke Direct Fuel Injection Engine

Jeff R. Wasil, Justin Johnson and Rahul Singh
BRP US Inc.

ABSTRACT

In pursuit of reducing dependencies on foreign oil coupled with U.S. renewable fuel standards and an overall focus and interest in greenhouse gas emissions, investigations continue on feasibility of replacement biologically derived fuels such as ethanol and butanol. Majority of existing recreational products such as marine outboard engines, boats, personal watercraft, all terrain vehicles and snowmobiles are carbureted or operate open-loop, meaning the engine does not have the capability to sense air-fuel ratio. Ethanol has a specific energy content that is less than gasoline. Without means to compensate for air-fuel ratio requirements of specific fuels, open-loop engines may suffer from a condition known as enleanment, in which catastrophic engine failure may result.

On the contrary, butanol has specific energy content closer to that of gasoline, suggesting open-loop engines may be less prone to negative effects of increased biologically derived fuel concentrations in gasoline.

This is a preliminary investigation into the effects of butanol/gasoline mixtures on a two-stroke direct injection recreational marine outboard engine. Additionally, ethanol/gasoline mixtures are also tested as comparison. Engine performance, combustion characteristics and emission results including overall effects of various butanol/gasoline and ethanol/gasoline blends will be explored.

INTRODUCTION

Engines used in a marine environment to power recreational craft are subject to very different operating conditions, usage cycles and overall physical running conditions than automotive engines. Therefore, it is important to understand these variations on how fuel blends primarily intended for automotive use may affect recreational marine engines and fuel systems.

Engine and drive weight is very critical for recreational marine products. Engine power to weight ratio has a direct effect on vessel performance and fuel economy. Additionally, it is not uncommon for recreational marine engines to be operated at wide open throttle (WOT) at rated speed for extended periods of time. During WOT, components are stressed more, not only from a mechanical standpoint, but also thermally. Subtle differences in combustion as a result of fuel properties can have a significant affect on performance, engine durability and emissions [1, 2].

According to the National Marine Manufactures association (NMMA), as of 2007, 12,185,568 gasoline powered recreational boats are currently registered in the United States [3]. Of that, approximately 225,000 have been retired from the fleet, which is less than 2% of the total powerboat fleet. The recreational marine industry as a whole has one of the oldest fleets of the engine sector. This results in a particularly difficult challenge in development of alternative fuels that will minimize engine run-ability issues, fuel system component

issues or potential engine failures considering the wide range and age of products currently still in use.

Several different materials are used for boat fuel tank construction including aluminum, polyethylene and fiberglass. Alternative fuel compatibility with different types of fuel tank materials needs to be considered and understood [4, 5].

Most boat fuel systems are vented directly to the atmosphere, which allows moisture to enter the fuel tank during daily diurnal temperature changes. This is further complicated by the marine environment itself - in which water or salt water is more likely to be inadvertently introduced into fuel systems. Moreover, typical usage of boats, especially in northern parts of the US, equates to longer periods of storage and subsequently potential for more fuel system related issues [6].

With respect to the aforementioned vented fuel system issue, as compared to ethanol, butanol is not hygroscopic and is much less susceptible to phase separation. Figure 1 shows the difference between ethanol and butanol fuels when 10% H_2O is added to each fuel. A colorant was added to highlight differences between the two samples. As shown, the cylinder containing ethanol on left has phase separated, meaning water and ethanol have formed an aqueous mixture forcing the gasoline to the top of the cylinder. In the cylinder, on the right containing butanol, water has settled to the bottom of the cylinder, leaving butanol and gasoline for the most part unaffected. Phase separation with ethanol causes additional engine enleanment due to both the fact that gasoline is displaced and water is present in the fuel causing the engine to ingest an ethanol water mix. Lack of phase separation in presence of H_2O is a desirable basic property of butanol, not only for the recreational marine industry, but also for the overall fuel distribution network, as butanol could be successfully delivered in existing pipelines [7].

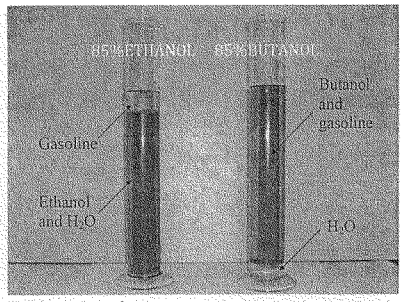


Figure 1. Effect of adding 10% water by volume to 85% ethanol and 10% water by volume to 85% butanol.

TEST SETUP

This section includes a description of the test engine, fuel flow system, test fuels, emissions analyzers, combustion analysis equipment, engine cooling water system, and overall test process. A schematic of engine test cell set-up is presented in Figure 2.

TEST ENGINE

A three cylinder 90 horsepower (67.1 kW) spray-guided stratified charge direct injection two-stroke production outboard engine was used for testing. The engine operates open-loop and does not have any type of combustion feed back sensor. This particular engine was chosen as it tends to be slightly more knock and fuel sensitive. Moreover, it is a scalable design, as this configuration forms 150, 175 and 200 horsepower V-6 outboard engine models. Engine specifications are shown in table 1.

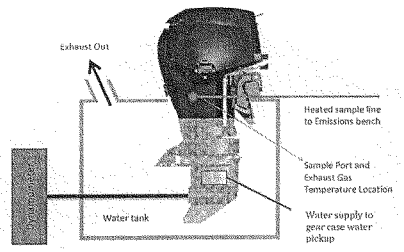


Figure 2. Engine test setup

Table 1. Test Engine Specifications

Model Year	2010
Fuel System	Gasoline Direct Fuel Injection (GDI)
Emissions Rating	California Three-Star Ultra-Low
Engine Cycles	2
Valves	Reed
Number of cylinders	3
Displacement	1296
Rated power HP (kW)	90 (67.1)
Full throttle operating range	4500 - 5500
Idle speed	650
Engine Hrs	175
Midsection length (inches)	20

FUEL AND FUEL FLOW INFORMATION

Fuel used for baseline emissions testing and as a base for blending is Indolene clear, which is a standardized gasoline test fuel that conforms to EPA CFR part 1065 requirements for certification testing [8]. Fuel flow is measured volumetrically using a Pierburg 60 lph fuel metering system along with a Calibron Densitrak DT625L density meter to arrive at fuel consumption in grams per hour. The fuel specifications are shown in Table 2. Calculated stochiometric air/fuel ratios for various alternative fuel blends are shown in Figure 3.

Various amounts of butanol or ethanol were blended with base indolene fuel to arrive at the desired concentrations of alternative fuel by volume:

- (B-10): 10% Butanol, 90% Indolene
- (B-15): 15% Butanol, 85% Indolene
- (B-20): 20% Butanol, 80% Indolene
- (E-10): 10% Ethanol, 90% Indolene
- (E-15): 15% Ethanol, 85% Indolene

Table 2. Test Fuel Specifications

Property	Gasoline	Ethanol (CH3OH)	n-Butanol (C4H9OH)	Indolene
Specific gravity @60F	0.72-0.75	0.79	0.8133	0.74
Net Lower Heating Value (BTU/lbm)	18700	11600	14280	19500
Octane Number Research	91-100	111	96	96
Motor	82-92	92	80	88
Stoichiometric AFR	14.6	9	11.1	14.3
Self-Ignition Temperature (C)	450	420	343	450

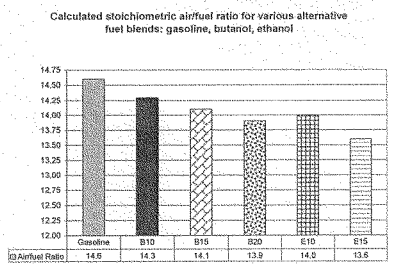


Figure 3. Calculated stoichiometric air/fuel ratio for various butanol and ethanol blends.

EMISSION ANALYZERS

A Pierburg AMA-2000 five-gas emissions bench was used for emissions analysis. A heated flame ionization detector (FID), heated chemoluminescence detector (CLD), non-dispersive infrared (NDIR) and paramagnetic analyzers were used for measurements of THC, NOx, CO, CO_2 and O2 respectively.

COMBUSTION ANALYSIS

An AVL Indicom 2 crank-based combustion analysis system was used to acquire 500 cycles of cylinder pressure on all three cylinders. Data was then processed to determine, burn rates, %COV of IMEP, misfire rate and to quantify knock characteristics.

WATER COOLING SYSTEM

Engine cooling water is supplied to the engine through the gear-case water pick up as shown in Figure 2. Water pressures are regulated with a Tescom ER-3000 electronic pressure controller to provide pressures typically seen at the gear case of a boat while underway.

TEST PROCESS

For each test fuel, the engine was run according to the International Council of Marine Industry Associations (ICOMIA) five-mode steady state test cycle as shown in Table 3 [9]. Two consecutive five mode emissions tests followed by two wide open throttle (WOT) power tests were conducted on each fuel blend. This was done in order to more accurately account for small deviations in test results. The average results from two tests on each fuel blend are reported. Five gas emissions HC, NOx, CO and CO_2, exhaust gas temperature, fuel flow, and combustion characteristics were recorded for each test mode and test fuel. EGT and emissions were sampled in the midsection megaphone, just below the base of the engine powerhead as indicated in Figure 2.

No changes or modifications to the base engine calibration, spark timing or injection timing were made at anytime during the testing process.

Table 3. ICOMIA five mode steady state marine test cycle [9].

Mode	% RPM	% Torque	% Weight Factor
1	100	100	6
2	80	71.6	14
3	60	46.5	15
4	40	25.0	25
5	Idle	0	40

RESULTS

Figure 4 shows the result of increasing butanol percentages by volume on HC + NOx emissions at different test modes in g/hr. As shown, a noted decrease in HC + NOx was observed at wide open throttle (test mode 1). Increase in HC + NOx occurs at mode 4 with increasing amounts of butanol. This is due to a higher number of misfires which directly contribute to an increase in HC emissions. Combustion data shown in Figure 5 indicates that the number of misfires at mode 4 increases with increasing quantities of butanol. Mode 4 is operated in a spray guided, stratified mode of combustion where the fuel is injected late in the cycle (70-50 degrees BTDC) and ignited directly by the spark plug as the fuel cloud passes by. As a result, the running quality, or misfire rate of the engine is susceptible to the local AFR at the spark plug and to the vaporization & burn rates of the fuel [10].

ICOMIA five mode weighted HC + NOx in g/kW-hr for increasing amounts of butanol by volume is shown in Figure 6. As shown, gradual reductions in HC + NOx are achieved as the concentration of butanol in gasoline is increased with the greatest reduction occurring at 15% butanol by volume. Mode 4 emission increases are offset by reduction in emissions at Mode 1.

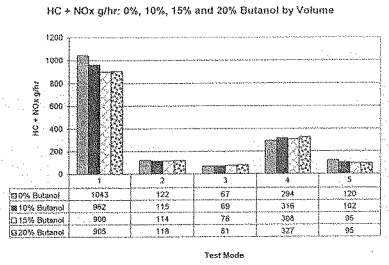


Figure 4. Total Hydrocarbons plus Nitrogen Oxides (HC + NOx) g/hr per test mode with increasing amounts of butanol by volume. (Average of two tests per test fuel)

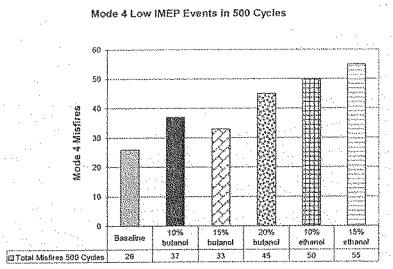


Figure 5. Total engine misfire rate at Mode 4 with increasing volumes of butanol and ethanol. Misfire is calculated as an event <75% of average IMEP for the 500 cycle data sample. (Average of two tests per test fuel)

Carbon Monoxide emissions in g/hr per mode are shown in Figure 7 for increasing amounts of butanol by volume. As shown, reductions in CO emissions are due to the increased oxygen content of butanol. The overall ICOMIA five mode weighted CO emissions in g/kW-hr (Figure 8) was reduced by approximately 15% using B-20 as compared to the baseline fuel.

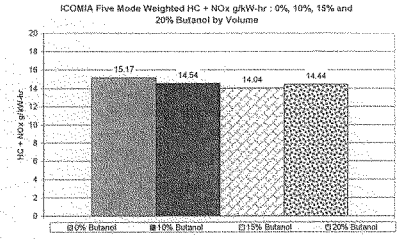


Figure 6. Total ICOMIA five mode weighted Hydrocarbons plus Nitrogen Oxides (HC + NOx) g/kW-hr with increasing amounts of butanol by volume. (Average of two tests per test fuel)

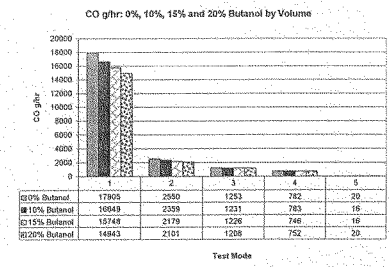


Figure 7. Carbon Monoxide (CO) g/hr per test mode with increasing amounts of butanol by volume. (Average of two tests per test fuel)

Overall ICOMIA five mode weighted Carbon Dioxide (CO_2) emissions in g/kW-hr are presented in Figure 9. A minimal increase on CO_2 was observed with increasing amounts of butanol by volume.

Exhaust gas temperatures at 5 different modes are shown in Figure 10. A two percent increase in exhaust gas temperature was observed at mode 1 (WOT) with B-20 as compared to the baseline fuel. At Modes 2 and 3, on average, a six percent decrease in exhaust gas temperature was observed. At these test modes, the engine relies on post oxidation in which additional thermal reaction is

occurring in the exhaust. This decrease in temperature is most likely due to the change in air/fuel ratio requirements of each specific test fuel. However, it appears this reduction in EGT at modes 2 and 3 do not significantly affect the HC + NOx emissions at these modes.

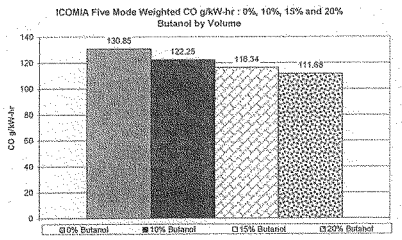


Figure 8. Total ICOMIA five mode weighted Carbon Monoxide (CO) g/kW-hr with increasing amounts of butanol by volume. (Average of two tests per test fuel)

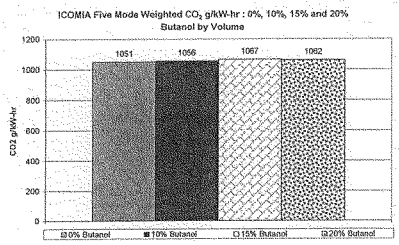
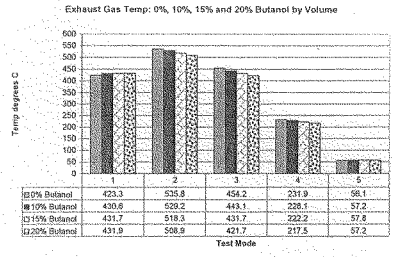


Figure 9. Total ICOMIA five mode weighted Carbon Dioxide (CO_2) g/kW-hr with increasing amounts of butanol by volume. (Average of two tests per test fuel)

Engine performance as indicated by wide open throttle corrected brake horsepower was maintained for increasing amounts of butanol by volume as shown in Figure 11.



	1	2	3	4	5
0% Butanol	423.3	535.8	454.2	231.9	58.1
10% Butanol	430.6	529.2	443.1	226.1	57.2
15% Butanol	431.7	518.3	431.7	222.2	57.8
20% Butanol	431.9	508.9	421.7	217.5	57.2

Figure 10. Exhaust gas temperature (EGT) per mode with increasing amounts of Butanol by volume. (Average two tests per test fuel)

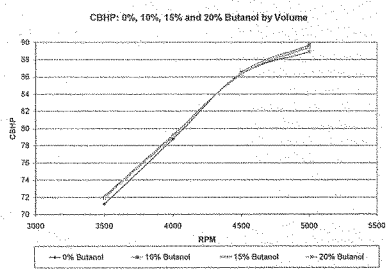


Figure 11. Wide open throttle corrected brake horsepower with increasing amounts of butanol by volume. (Average of two tests per test fuel)

COMPARISON BETWEEN BUTANOL AND ETHANOL

This section explores differences in emissions comparing B-10, B-15, B-20, E-10 and E-15. As shown in Figure 12, E10 and E-15 results in leaner running of the engine as indicated by raw CO percentage as compared to butanol. B-20 results in very similar raw CO in percent as E-10. A twenty percent reduction in raw CO using E-15 was observed at mode 1 (WOT) in comparison to a six percent reduction in raw CO using B-15. Figure 13

indicates the five mode weighted CO in g/kW-hr for the various fuel blends. Five mode weighted HC + NOx emissions were similar on both butanol and ethanol with a slight increase in emissions with ethanol as compared to butanol as shown in Figure 14. CO_2 emissions were generally lower with butanol blends as compared to ethanol blends as indicated in Figures 15 and 16.

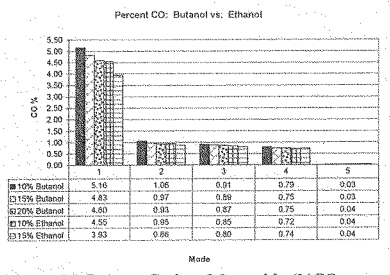


Figure 12. Percent Carbon Monoxide (%CO raw gas sampling) per mode comparing 10% butanol, 15% butanol, 20% butanol, 10% ethanol, and 15% ethanol by volume. (Average two tests per test fuel)

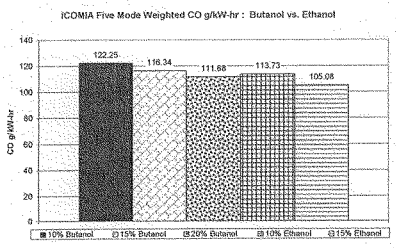


Figure 13. ICOMIA five mode weighted Carbon Monoxide (CO) g/kW-hr comparing 10% butanol, 15% butanol, 20% butanol, 10% ethanol, and 15% ethanol by volume. (Average two tests per test fuel)

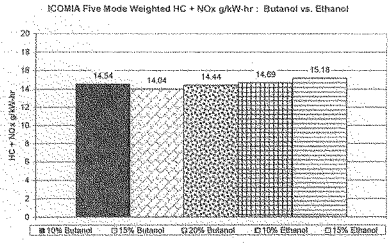


Figure 14. ICOMIA five mode weighted HC +NOx g/kW-hr comparing 10% butanol, 15% butanol, 20% butanol, 10% ethanol, and 15% ethanol by volume. (Average two tests per test fuel)

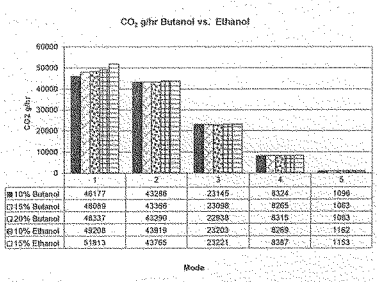


Figure 15. CO_2 g/hr per mode comparing 10% butanol, 15% butanol, 20% butanol, 10% ethanol, and 15% ethanol by volume. (Average two tests per test fuel)

Lambda was measured using the modified Spindt method based on raw five-gas emissions for the various alternative fuel blends [11]. Figure 17 indicates the measured Lambda for increasing amounts of alternative fuel blends. Notice that 20% butanol by volume yields similar Lambda values as 10% ethanol by volume at modes one and two.

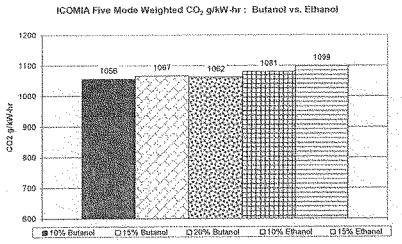


Figure 16. ICOMIA five mode weighted CO_2 g/kW-hr comparing 10% butanol, 15% butanol, 20% butanol, 10% ethanol, and 15% ethanol by volume. (Average two tests per test fuel)

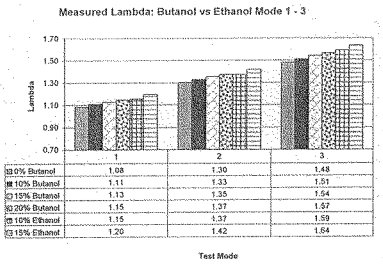


Figure 17. Measured Lambda comparing baseline fuel to 10% butanol, 15% butanol, 20% butanol, 10% ethanol, and 15% ethanol by volume. (Average two tests per test fuel)

In addition, cylinder pressure data was analyzed at Mode 1 to evaluate the impact of butanol and ethanol concentration on combustion quality. Figure 18 indicates that the % COV of IMEP does not radically change with increasing quantities of butanol or ethanol which is consistent with the findings of direct fuel injection closed-loop automotive engine research [12]. Cylinder three has a slightly higher COV due to knock reduction strategies in the engine calibration.

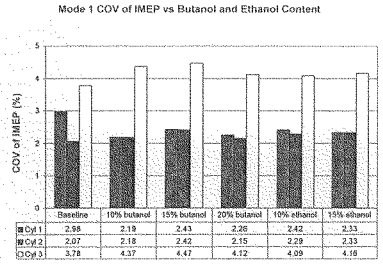


Figure 18. Mode 1 (WOT) %COV of IMEP by cylinder for increasing quantities of butanol and ethanol.

The Mahle Knock Index is calculated to determine changes in knock activity due to higher butanol or ethanol concentrations and is calculated by assigning a weighting to the Knock Peak value for each cycle. The weightings for each knock peak are then summed and divided by the number of cycles, which gives the Knock Index. A higher Knock Index value indicates more knock activity. The absolute value of the Knock index will vary depending on filtering frequencies and weightings applied to the Knock Peak value. The knock peak value is determined by filtering and rectifying each cylinder pressure trace so that only the oscillations from the knock event remain. The peak oscillation from that event becomes the Knock Peak Value for that cycle. This calculation is done for each cycle on each individual cylinder. Figure 19 shows that the Mahle Knock Index remained mostly unchanged. This is due to the increased octane rating of the higher butanol and ethanol content fuels. The engine was calibrated on a fuel similar to the baseline fuel, allowing the knock characteristics of the lower octane fuel to be minimized. As a result, any increase in octane number will reduce the knock activity.

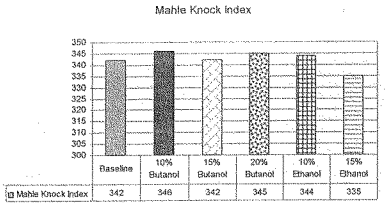


Figure 19. Mode 1 (WOT) Mahle Knock Index for all cylinders.

Mode 1 burn rates were also calculated for each concentration of butanol and ethanol. Figure 20 indicates the engine average burn rates for increasing quantities for butanol and ethanol. The peak burn rate for butanol was slightly reduced (0.5%/deg) and occurred 1-2 degrees earlier in the cycle. For increasing ethanol content, the peak burn rate is reduced the same amount, but phased 2-3 degrees earlier in the cycle.

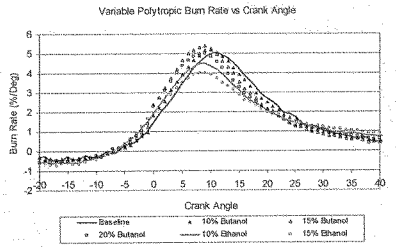


Figure 20. Mode 1 Engine average burn rate.

Figures 21, 22, and 23 show normalized cylinder pressures for each of the cylinders averaged over 500 cycles. In all instances, the higher concentrations of butanol and ethanol incrementally advance the combustion process, with peak cylinder pressure occurring 2 to 3 degrees earlier than the baseline fuel. This correlates with the advance in the burn rate for increasing butanol and ethanol content and is caused by a decrease in the ignition delay, or zero to 10% burn duration.

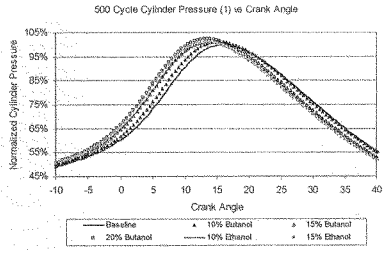


Figure 21. Mode 1 Cylinder 1 pressure averaged over 500 cycles.

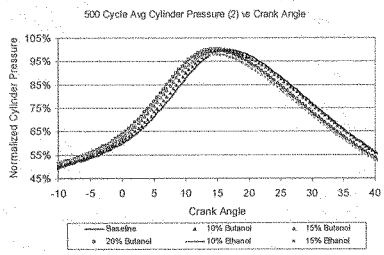


Figure 22. Mode 1 Cylinder 2 pressure averaged over 500 cycles.

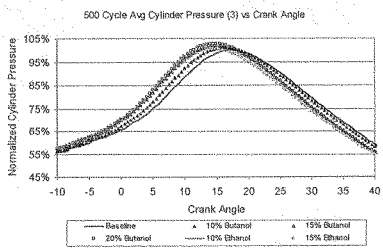


Figure 23. Mode 1 Cylinder 3 pressure averaged over 500 cycles

SUMMARY/CONCLUSIONS

This work was intended to be a first investigation assessing potential of butanol as a drop-in alternative fuel blend for direct injection two stroke recreational marine engines. A significant amount of work is needed to assess wide scale effects of butanol on gasoline recreational marine engine technologies and fuel systems prior to drawing any significant conclusions. However, based on this study, initial results look promising and are summarized below.

- Compared to the same percentage blend of ethanol, butanol blends result in less engine enleanment as indicated by CO and Lambda. This means butanol can be tolerated in higher blend percentages in open-loop engines as compared to ethanol.
- 20% butanol by volume resulted in similar emissions and engine power as 10% ethanol by volume.
- Misfire events at mode 4 (fully stratified) generally increased slightly with increasing amounts of butanol by volume but misfire events were more prevalent with ethanol than butanol.
- Compared to the same percentage blend of ethanol, butanol blends result in less Carbon Dioxide (CO_2), which is considered a form of green house gas emission. The reduction in CO_2 for butanol blends compared to ethanol blends is due in part to the stronger enleanment effects of ethanol, which cause HC emissions to decrease more substantially, NOx emissions to increase slightly and CO emissions to decrease. Because there is less HC, less CO and more NOx, this forces the carbon (as part of the carbon balance) to convert to CO_2.
- No discernable changes to the WOT COV of IMEP or knock characteristics were noticed, with higher concentrations of butanol or ethanol.
- Combustion phasing was slightly advanced with increased levels of butanol and ethanol.

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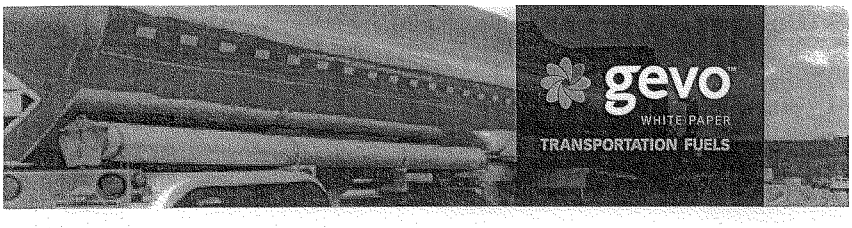

Renewable Solution

ISOBUTANOL—A RENEWABLE SOLUTION FOR THE TRANSPORTATION FUELS VALUE CHAIN

Executive Summary

The demand for a clean, renewable biofuel increases as new benchmarks are legislated and increased pressure is placed on the petroleum industry to reduce America's dependence on imported fossil fuels for energy consumption.

Gevo®—a leader in next-generation biofuels—has developed and patented a cost-effective process, Gevo Integrated Fermentation Technology® (GIFT®), which converts fermentable sugars from sustainable feedstocks into isobutanol, a biobutanol product that provides solutions to many of the value chain issues highlighted by first-generation biofuels.

In this paper, you'll learn how isobutanol provides a renewable solution to improve the transportation fuels value chain.

What You Will Learn:

» Isobutanol is a dynamic platform molecule.
» Isobutanol ships in pipeline systems.
» Isobutanol can address future regulatory issues now.
» Isobutanol mitigates end-user challenges.

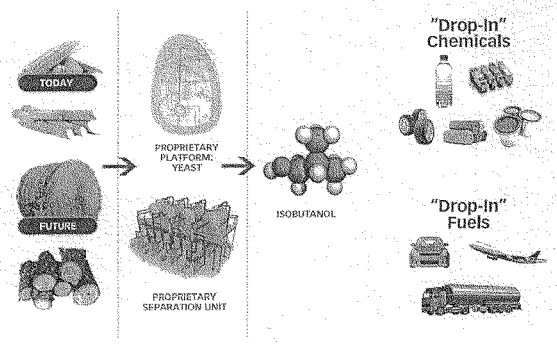

Exhibit E

As the demand for renewable sources of fuels intensifies, it is imperative that the transportation fuels industry has the necessary solutions to optimize the value chain. Gevo's renewable isobutanol can potentially be applied across the entire transportation fuels industry and shipped through the pipeline, while complying with government regulations and mitigating end user issues.

To find out how isobutanol is the next-generation biofuel, contact us at:

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***Notice Regarding Forward-Looking Statements**
Certain statements in this document, including, without limitation, Gevo's ability to produce cellulosic isobutanol once biomass conversion technology is commercially available, may constitute "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. These forward-looking statements are made on the basis of the current beliefs, expectations and assumptions of the management of Gevo and are subject to significant risks and uncertainty. Investors are cautioned not to place undue reliance on any such forward-looking statements. All such forward-looking statements speak only as of the date they are made, and the Company undertakes no obligation to update or revise these statements, whether as a result of new information, future events or otherwise. For a further discussion of risks and uncertainties that could cause actual results to differ from those expressed in these forward-looking statements, as well as risks relating to the business of Gevo in general, see the risk disclosures under the section captioned "Risk Factors" in Gevo's final prospectus related to its initial public offering filed pursuant to Rule 424(b) under the Securities Act of 1933, as amended on February 9, 2011.

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Butanol Evolves

BACKGROUND ON BUTANOL

The use of butanols in gasoline goes back to the 1970s–'80s and has been approved under Section 211(f) of the Clean Air Act through the "Arconol," "DuPont" and "Octamix" waivers. At that time, tert-butyl-alcohol (TBA), a man-made material, was the prime butanol used, although research suggests that isobutanol was also being evaluated. These butanols were produced from petroleum processes: Both n-butanol and isobutanol were produced using the oxo process, and TBA was a by-product of the PO process.

Gevo has developed a proprietary biochemical pathway to produce renewable isobutanol, a four-carbon alcohol with many attributes that may aid the transportation fuels industry across its value chain. It is now being evaluated as a next-generation biofuel.

Isobutanol should not be confused with the other isomers in the butanol family (n-butanol, sec-butanol, tert-butyl-alcohol [TBA]). It is a naturally occurring material with a musky odor found in many essential oils, foods and beverages (brandy, cider, gin, coffee, cherries, raspberries, blackberries, grapes, apples, hop oil, bread and Cheddar cheese).

Today, Gevo has developed a renewable method to produce a 98+ percent–purity product using sugars from any available source. The initial plan is to convert existing U.S. cornstarch ethanol plants into isobutanol plants for a fraction of the cost to build new facilities. Gevo also plans to upgrade some of these facilities to produce an isobutanol that will be classified as an advanced biofuel as defined by EPA under the U.S. Energy Independence and Security Act (EISA), to allow cellulosic sugars to be used as a feedstock as they become cost competitive, and to allow multiple products to be generated.

ISOBUTANOL IS A NEXT-GENERATION RENEWABLE FUEL AND A "BUILDING BLOCK" TO THE FUTURE FUELS VALUE CHAIN

To become a next-generation renewable fuel, it is paramount that the manufacture of a renewable product leverages existing infrastructure and extends the current fuels value chain. With the U.S. oil-and-gas downstream industry (inbound distribution, refining, outbound distribution and marketing) conservatively valued at over $500 billion, it would be inefficient to build an entirely new supply chain infrastructure to accommodate a renewable product industry valued at less than 10 percent of the downstream industry.

The optimal value chain for a transportation fuel, including renewables, might look like this (Figure 1):

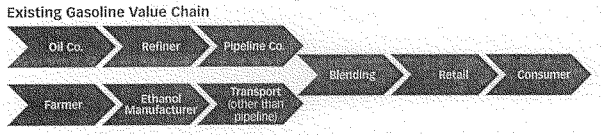
Figure 1

Feedstocks are shipped to a producer (refiner, blender or bio-refiner), where they are converted to a finished product, which is then cost-effectively shipped to market, and sold to the end user based on a specification that meets regulatory needs. Over time, as regulations have been introduced, the optimal value chain has remained intact.

With the advent of the Renewable Fuel Standard (RFS) and EISA, the value chain, using first-generation renewable products, has been changed; for example, ethanol enters the value chain at the terminal (Figure 1a), where it is either blended with a sub-octane gasoline product to produce the finished gasoline, or is added to a finished gasoline to produce a higher-octane product.

Figure 1a

Existing Gasoline Value Chain

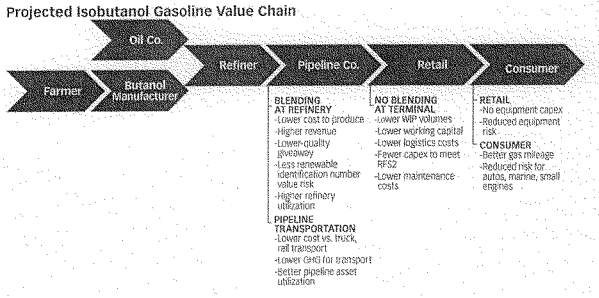


This inefficiency primarily stems from the inability of first-generation biofuels to be shipped in a pipeline, adding system cost(s) as additional capital is required at the terminals for blending these products. Additionally, giveaway costs increase as refiners no longer ship finished products but are held legally accountable for the finished-product specification. If the trend toward using first-generation biofuels grows, pipeline throughput volumes may decrease, giving rise to potential tariff increases on the remaining shippable products.

By analogy, isobutanol is today's "smartphone" to first-generation biofuels' "cell phone;" it can re-optimize the value chain with its ability to be shipped in pipelines, both inbound to and outbound from a refining/blending facility, as shown in Figure 1b. The versatility of isobutanol's properties as a blendstock for gasoline and its ability to be converted to other valuable products give the downstream industry great flexibility.

Figure 1b

Projected Isobutanol Gasoline Value Chain



Dynamic Molecule

ISOBUTANOL IS A DYNAMIC PLATFORM MOLECULE

Isobutanol is an ideal platform molecule, a more flexible and versatile renewable alternative to current biofuels. It can be used as a "drop in" gasoline blendstock; it converts readily to isobutylene, a precursor to a variety of transportation fuel products such as iso-octene (gasoline blendstock), iso-octane (alkylate—high-quality gasoline blendstock and/or avgas blendstock), iso-paraffinic kerosene (IPK, or renewable jet) and diesel. Isobutanol is not constrained to just the gasoline pool; hence, its value to a producer and/or purchaser is its flexibility.

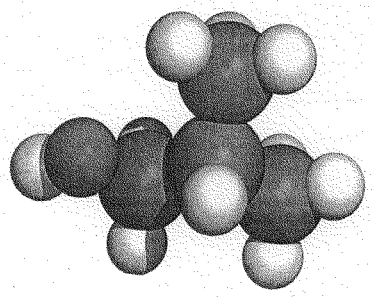
Gasoline and Renewables

The oil embargoes of the 1970s drove the introduction of alternative, renewable feedstocks for the oil-and-gas industry. At the time, the EPA granted various waivers allowing methanol, ethanol, butanols and other materials into gasoline. By the 1990s, the Clean Air Act required gasoline to have an oxygenate added to improve urban air quality. Until 2005, there were two primary options: MTBE (produced by the refinery and optimally blended into the finished product) and ethanol (produced locally and blended into gasoline, not always optimally, at various distribution terminals).

With the creation of the Renewable Fuel Standard (RFS) and the elimination of MTBE as a viable blendstock in 2004, ethanol became the prime renewable material. Production increased dramatically. As more ethanol entered the market, its price decreased relative to gasoline and its usage increased. The 2007 Energy Independence and Security Act (EISA), which requires different categories of renewable fuels (based on greenhouse gas emission reductions), has also increased the volume obligation of a refiner or blender to use renewable products. In addition, as sulfur and benzene concentrations in gasoline have been addressed, it is anticipated that there will be continued efforts to lower ozone levels, with gasoline volatility being a key driver.

The first-generation renewable products have provided a good start to improving air quality and increasing energy independence, but may not provide an optimal economic solution across the value chain. Isobutanol, as the next-generation product, builds on the foundation and provides additional solutions to various challenges not met by first-generation products. Some of these include:

» Blend properties in gasoline
» Volatility
» Phase separation
» Energy content
» Blend wall



Blend Properties in Gasoline

Isobutanol has several blend property advantages: low Reid Vapor Pressure (RVP), above-average octane, good energy content, low water solubility and low oxygen content (Figure 2).

Figure 2

	ETHANOL	ISOBUTANOL
Blend RVP	18–22 psi	4.5–5.5 psi
Blend Octane	112	102
Energy Content (% of gasoline)	65%	82%
Water Solubility	Fully Miscible (100%)	Limited Miscibility (8.5%)
Oxygen Content	35%	22%

Volatility

As sulfur and benzene content in gasoline is limited by legislation, it is likely that efforts to control ozone, which have already increased, will continue to increase in the future.

A key tool used by state regulatory agencies for reducing ozone precursors in the air is through reduced volatility of gasoline as measured by RVP. As ethanol's RVP blend value is high (~18 psi for E10 blends), the base blendstock for oxygenated blending (BOB) must be low to accommodate this high-RVP material. This problem will be exacerbated as any ethanol blends less than 9 percent or greater than 10 percent currently do not qualify for a 1-psi waiver.

Isobutanol's low-blend value RVP (~5.0 psi for 12.5 percent–volume blends) (Figure 3) allows refiners to decrease costs by optimally blending additional lower-cost blendstocks (butane, pentane, NGLs, naphtha) and/or reducing the purchases of more costly low-RVP alkylate. For example, by using Baker and O'Brien's proprietary PRISM™ model (Figure 4) , a refinery serving a low-RVP gasoline market was able to eliminate alkylate purchases and significantly increase butane purchases by using isobutanol instead of ethanol.

Figure 3

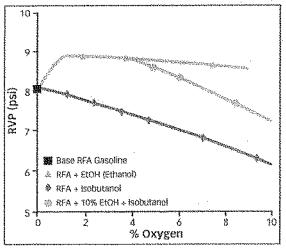
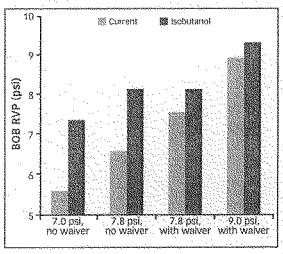


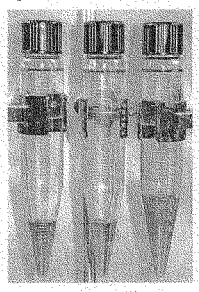
Figure 4



Phase Separation

Because gasoline may come in contact with water, it is important that the blendstocks remain in the hydrocarbon phase and not migrate into the water. Ethanol, a highly polar material, will separate from the gasoline phase into the water phase, degrading the gasoline's octane. Isobutanol is less polar than ethanol, and tends to act like a hydrocarbon with very limited amounts moving from the gasoline phase to the water phase (Figure 5). As a result, there is no dilution of the gasoline's octane value, and operational issues related to water content are reduced or eliminated.

Figure 5



Gasoline with 10% Water | Isobutanol-Blended Gasoline with 10% Water | Ethanol-Blended Gasoline with 10% Water

Energy Content

Isobutanol has approximately 82 percent of the energy value of gasoline. Although every engine is different, higher energy content typically translates into greater fuel economy. In addition, per EISA, as isobutanol has 30 percent more energy than ethanol, its equivalence value (EV) is 1.3 (Figure 6), which translates into significantly more renewable identification numbers (RINs) being generated than ethanol.

Figure 6

BIOFUEL	EQUIVALENCE VALUE (EV)
Ethanol	1.0
Isobutanol	1.3
Biodiesel (FAME)	1.5
Renewable Jet (Biojet, JPK)	1.6*
Renewable Diesel	1.7

*Estimate based on EISA formula.

Blend Wall

Engine manufacturers are concerned about exceeding 3.5 percent–by-weight oxygen levels, and obligated parties need to generate even greater RINs. Isobutanol provides a solution to these needs. If isobutanol were used at E10 oxygen content levels (3.5 percent–by-weight oxygen), it would generate more than twice the RINs. Even at transitional "substantially similar" oxygen levels (2.7 percent– by-weight oxygen), isobutanol generates more RINs than either E10 or E15 (Figure 7).

Figure 7

	OXYGEN CONTENT	EV	RINS GENERATED PER 10 GALLONS GASOLINE BLENDED
12.5% Isobutanol	2.7	1.3	16.25
10% Ethanol	3.5	1.0	10.00
16.1% Isobutanol	3.5	1.3	20.93
15% Ethanol	5.2	1.0	15.00

Converting to Jet Fuel

ISOBUTANOL CAN ALSO BE CONVERTED TO PRODUCE A RENEWABLE JET

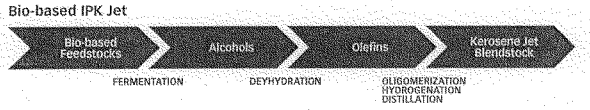
According to the International Civil Aviation Organization (ICAO), environmental efficiency gains from technological and operational measures may not offset the overall emissions that are forecast to be generated by the expected growth in air traffic. As a result, the airline industry is evaluating sustainable alternative fuels to reduce its greenhouse gas (GHG) emissions profile, while improving local air quality. It is the ICAO's view that the development and use of sustainable alternative fuels may play an active role in improving the overall resource allocation and security of aviation fuels supply, perhaps by stabilizing fuel prices. A global framework has been established for sharing information on best practices and/or initiatives to allow sustainable alternative aviation fuels to be developed and brought to market.

IPK/KEROSENE

Isobutanol is an ideal platform molecule to produce renewable iso-paraffinic kerosene (IPK), a blendstock for jet fuel. Through known technology, isobutanol can be readily converted to a mix of predominantly C12/C16 hydrocarbons (Figure 8).

Figure 8

Bio-based IPK Jet



Gevo's IPK offers several benefits:

- Blend Rate—may be blended at up to a 1:1 ratio with petroleum jet.
- Properties—very low freeze point (–80°C), high thermal oxidation stability, and meets ASTM distillation curve requirements.
- Regulatory—using EISA's formula, the projected EV is approximately 1.6, which, at a blend rate of 50 percent, would generate 80 RINs per 100 gallons of finished product.
- Tax Credit—it qualifies for a $1.00/gallon tax credit under IRS Title 26, Subtitle A, Chapter 1, Subchapter A, Part IV, Subpart D, Article 40A.f.3.
- GHG—using renewable energy and/or improved feedstocks in the production process, it has the potential to significantly reduce GHG emissions.

Distribution Versatility

ISOBUTANOL CAN USE THE EXISTING PIPELINE DISTRIBUTION INFRASTRUCTURE

A key advantage for isobutanol to be adopted into the transportation fuels industry is its ability to be shipped in pipelines without negatively affecting the integrity, quality or operations of the pipeline system (Figure 9, below).

Pipelines are a key part of the value chain, and using the existing infrastructure to move product may provide significant advantages:

- There is value in blending at the refinery instead of at the terminal. According to a Solomon Associates presentation* finished fuel from a refinery appears to avoid giveaway costs estimated at $0.01 to $0.03 per gallon of finished gasoline.
- As ethanol volumes have grown, pipeline throughputs have fallen; with lower throughputs, tariffs on the remaining products may increase.
- Shipping material by pipeline is the most cost-effective manner to move liquid products compared to rail, barge and/or truck.

Isobutanol has the potential to be used in the existing pipeline system, both inbound and outbound, providing potential cost savings, flexibility and efficient access to end-user markets.

Figure 9

	ETHANOL		ISOBUTANOL	
Integrity				
Stress Corrosion Cracking	Yes		No	
Elastomeric Compatibility	Manageable		Highly Compatible	
Quality				
Oxygen Content in Gasoline	E10	3.5%	E10	2.7%
	E15	5.2%	E15	3.5%
Ship Neat Product	Qualified No		Qualified Yes	
Operations				
Blend Location	Terminal		Refinery/Terminal	
Segregated Storage	Yes		No	

*Use of a Waiver in Conventional Gasoline Blending—A Look at U.S. Refiner Trends by John Popielarczyk, October 2009, NPRA Q&A meeting.

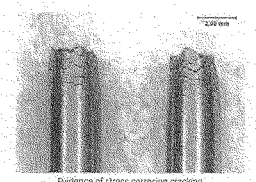
Integrity

There are two key measures of integrity:

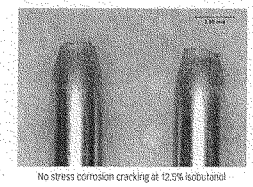
» Stress corrosion cracking (SCC)

» Elastomeric compatibility issues

Det Norske Veritas (DNV), a leading corrosion consultancy that has done significant work on the distribution of ethanol-blended gasoline, has also evaluated isobutanol. Based on DNV's conclusions, carbon steel is susceptible to stress corrosion cracking (SCC) in fuel-grade ethanol; however, no SCC was noted in isobutanol-containing gasoline at concentrations of 12.5 percent and 50 percent, nor was any SCC found with neat isobutanol, as shown at right. In addition, several elastomeric materials were evaluated with respect to their compatibility with isobutanol and gasoline; the tested materials showed better performance in isobutanol than in gasoline.



Evidence of stress corrosion cracking



No stress corrosion cracking at 12.5% isobutanol

Quality

Today, regulatory pathways exist for isobutanol to be used in gasoline at two volume levels, 12.5 percent under the EPA "substantially similar" ruling (2.7 percent by-weight oxygen content) and 16.1 percent under previous EPA waivers (DuPont, Octamix waivers allowing 3.5 percent by-weight oxygen content). Discussions with pipeline distribution companies have revolved around the shipping, handling and storage of three possible products: 12.5 percent and 16.1 percent by-volume isobutanol-containing gasoline and 100 percent neat isobutanol.

Operations

In recent years, many terminals have increased capital spending to handle blending of ethanol. At the same time, the volume throughput of pipelines has been reduced by the amount of ethanol blended at the terminal. Isobutanol, shipped to a refinery, optimally blended to reduce giveaway cost(s), and then shipped as a finished product to end-user markets, would use the existing assets more cost-effectively.

Regulations and RIN

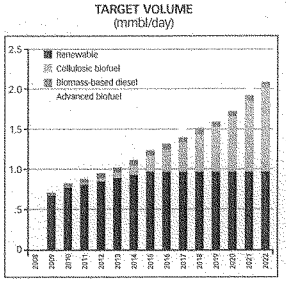
ISOBUTANOL CAN ADDRESS FUTURE REGULATORY ISSUES NOW

A key driver for isobutanol that will influence its adoption into the transportation fuels industry is the impact that existing and potential regulations may have on guiding which renewable fuels become prominent. Key issues include total RIN volume needed, RIN generation, type of RIN generated, 1 psi waiver and ozone control.

RIN Volume/Generation

EISA (or RFS2) set new volume targets for the industry; specifically, by 2022, 36 billion gallons per year (or about 2.4 million barrels per day) of renewable products are to be used [Figure 10]. To account for this volume, a renewable identification number (RIN) was established; using the concept of equivalence value (EV) [Figure 6, p. 5], which allows a multiplier based on energy content to be used, it is conceivable that the physical volume used by the transportation fuels industry is less than the EISA target volumes. For example, in Figure 11 (below), if 10 gallons of ethanol with an EV of 1.0 are used, 10 RINs are generated per 100 gallons of finished product. With isobutanol, if 12.5 gallons are used with an EV of 1.3, 16.25 RINs are generated per 100 gallons of finished product. The RINs generated are a function of the physical volume used multiplied by the EV of the renewable product.

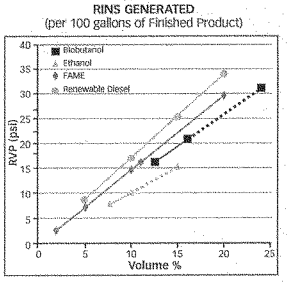
Figure 10



"Advanced" RIN Capable

A key component of the EISA legislation was the introduction of RIN types: renewable and advanced. The advanced category, with a minimum hurdle of reducing GHG emissions by 50 percent, has the subsets of cellulosic, biomass-based diesel and "advanced other." The ultimate volume requirement for the renewable type was set at 15 billion gallons per year (BGY), and for the advanced type at 21 BGY. Although target volumes were set for the cellulosic and biomass-based diesel categories, EPA has the authority to adjust these totals annually, based on availability, but it cannot reduce the total advanced requirement. As such, there may be a growing need [Figures 12, 13, p. 10] for products that meet the "advanced other" category, or products that have 50 percent lower greenhouse gas emissions compared to gasoline.

Figure 11



One psi Waiver

Another key driver of isobutanol adoption is a consistent standard with regard to volatility; for E10 blends, ethanol was granted a 1 psi waiver when the finished-product RVP was considered. If a state implementation plan (SIP) required a 9.0 psi RVP for conventionl gasoline, this specification would become 10 psi when using ethanol blends.

At present, only gasoline blends containing 9 percent to 10 percent ethanol are granted a 1 psi waiver. Hence, finished product with a 9.0 psi must have a base blendstock RVP substantially lower than 9.0 in order to accept higher ethanol blends, i.e., E15+.

With isobutanol, obligated parties have considerably greater formulation flexibility and might be able to go as high as 9.6 psi in their blendstock and still meet their Clean Air Act requirements without a waiver.

Figure 12

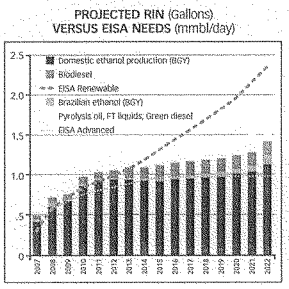
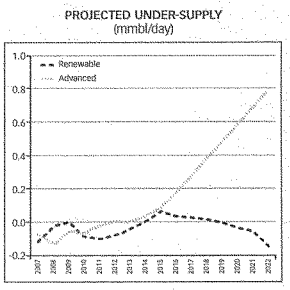


Figure 13



NOTE: Per EISA, corn starch-derived ethanol plants are excluded from achieving an "advanced other" level. However, starch-derived isobutanol plants have the ability to achieve the advanced status. As the only currently available advanced products are FAME biodiesel (limited volumes) and Brazilian ethanol imports, isobutanol provides a secure alternative to meet this need.

Ozone Control

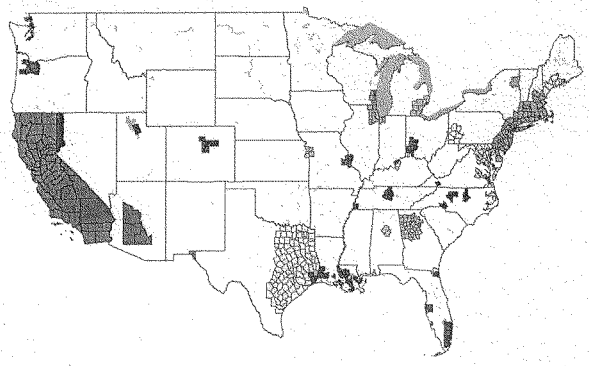
Ground-level ozone is harmful to breathe and damages crops, trees and other vegetation. Gasoline volatility is the key lever used by the states to control ozone precursors. There are already many markets requiring special RVP specifications (Figure 14). If the EPA target for ozone is set at 75 ppb, it is estimated that over 300 counties nationwide will fall out of compliance. In addition, a U.S. EPA Scientific Advisory Board (SAB) has recommended that the ozone target be lowered (perhaps to 60–70 ppb), which would have a dramatic impact on most of the U.S. gasoline market. Isobutanol, with its low-blend volatility, provides obligated parties greater flexibility to meet both lower volatility (RVP) and renewable fuel obligations.

Figure 14

Market RVP Specification	Gasoline Market Size	Isobutanol Market Opportunity
PSI	BGPY	BGPY
7.0 no waiver[1]	18	2.2
7.8 no waiver	16	1.9
9.0 no waiver	18	2.2
7.0 waiver	6	0.7
7.8 waiver	11	1.3
9.0 waiver	72	8.6

Increasing value

[1]Waiver = 1 psi RVP waiver given to ethanol in many markets.



Overcoming Concerns

ISOBUTANOL MITIGATES END-USER ISSUES

The concept of energy independence was established with the introduction of first-generation renewable fuels. However, in trying to increase the use of these products, several significant constraints must be addressed relative to the various end users: certification of storage tank/dispensing equipment, equipment operational concerns, product liability issues for convenience store operators, fuel mileage/maintenance issues and American pride/innovation. Isobutanol can address these concerns as the next step in the evolution of American-produced biofuels.

Fuel Dispenser Certification Concerns

Underwriters Laboratories (UL) establishes the safety requirements and testing procedures for automotive fuel dispenser systems (UL 87) and certifies new products to ensure they meet material compatibility, adhere to fire safety codes, and are consistent with related products. Although UL has certified certain dispensers for ethanol volumes greater than 10 percent, most existing dispensers used by convenience store operators were only tested and approved for 10 percent blends. The cost of replacing the dispensers is uneconomical for the operator. Isobutanol's initial use would be at EPA gasoline "substantially similar" levels eliminating the need to replace or certify fuel dispensers.

Consumer Labeling/Product Liability Concerns

EPA has given qualified approval for the sale of E15 blends for use in car model years 2001 and newer, and discussions are under way to determine an appropriate label to be displayed on the dispenser to ensure that the consumer uses the appropriate fuel for their car. Unfortunately, per EISA and its current legal framework, the liability to ensure that the consumer uses the right fuel is placed on the convenience store operator. Many operators find this risk to be too high to consider selling ethanol blends above 10 percent. Again, as isobutanol's initial use would be at EPA "substantially similar" levels, it would be considered the same as a conventional petroleum product.

Operational Concerns

The use of ethanol in gasoline has been encumbered by operational issues. In addition to its phase separation issues, it is a fairly strong solvent that tends to dislodge dirt/sludge from the dispensing equipment, causing dispenser filter problems and gasket leaking. Isobutanol is not as potent a solvent as ethanol, and based on preliminary discussions with dispenser equipment suppliers, is not expected to have the same issues as ethanol.

Price and Energy Content Concerns

Consumers tell us that although price remains a key driver of fuel purchase decisions, product performance as a reason for choosing a gasoline brand is increasing. Consumers are keeping their vehicles longer and taking better care of them; rethinking what goes in the tank is becoming more important. Any product that reduces fuel mileage and/or may increase maintenance costs will be avoided if there is a better alternative. Isobutanol has higher energy density than ethanol, and tests are being conducted to quantify this potential benefit to fleet operators and the general motoring public. Qualitatively, gasoline marketers are looking for ways to differentiate themselves, and having a fuel that is renewable but not ethanol is of high interest.

Marine and Small-Engine Concerns

For specialized uses, such as small-engine and/or marine fleet engines, it is paramount to have a fuel that does not cause operational safety issues and can meet EPA emission targets. As the amount of oxygen content in a fuel increases, the operating temperature of that engine increases, potentially causing undue wear and increased emissions. This is an issue with engines that do not have sophisticated instrumentation. In addition, safety issues have been highlighted, relative to higher idle speeds and unintentional clutch engagement.

The National Marine Manufacturers Association (NMMA), the Outdoor Power Equipment Institute (OPEI) and many of their member companies are evaluating isobutanol as a possible alternative to ethanol to help reduce emissions and eliminate phase separation issues. For example, BRP US Inc. recently conducted a study that found butanol-containing gasoline produced less greenhouse gas emissions and had less engine enleanment than ethanol-blended gasoline.

Summary

The petroleum industry needs to focus on innovation to meet future environmental regulations, achieve energy independence and mitigate end-user issues. Isobutanol is an ideal platform molecule to address these issues while benefiting the transportation fuels industry value chain.

Isobutanol may provide environmentally favorable options for the transportation fuels industry to position its products facilities and manufacturing processes to meet increasingly stringent regulatory policies and industry standards.

THE AUTHORS

Christopher Ryan, Ph.D.
Executive Vice President of Business Development

Dr. Christopher Ryan is the executive vice president of business development at Gevo. He started his tenure at Gevo in 2009 with more than 15 years of strategic leadership, business development, and research and product development in bio-based materials. Most recently, Dr. Ryan was chief operating officer and chief technology officer for NatureWorks, LLC, which he cofounded in 1997. While at NatureWorks, Dr. Ryan was involved in the development and commercialization of the company's new bio-based polymer from lab-scale production through the introduction and growth of PLA through its $300 million world-scale production facility. He also spent four years working in corporate R&D for HB Fuller, a specialty chemicals company.

Dr. Ryan completed the management of technology program at the University of Minnesota, Carlson School of Management, and holds a Ph.D. in organic chemistry from the University of Minnesota and a B.S. in chemistry from Gustavus Adolphus College.

Dave Munz, MBA
Business Development Manager, Transportation Fuels

Dave Munz joined Gevo in early 2008 and has been focused on placing isobutanol and/or its derivatives in the transportation fuels industry. His background includes business development, pricing, and/or sales and marketing positions with DuPont (U.S. and UK), Conoco (upstream and downstream, U.S. and UK) and CountryMark. Over the past several years, Mr. Munz's focus has been on renewable fuels and their efficient integration across the value chain within the oil-and-gas industry.

Mr. Munz has a BS degree in chemical engineering from the University of Wisconsin—Madison and an MBA from Warwick University in England.

Gary Bevers
Downstream Petroleum Consultant

Gary Bevers has 28 years' experience in product and market development for innovative eSupply Chain Management solutions designed to increase downstream petroleum distribution efficiencies. His firm focuses on systems and logistics support projects that help companies drive sales and operations more efficiently, especially online. He developed Internet-based e-business solutions for TETRA Technologies for oil and gas and handled product marketing for Exxon Chemical, where he received its "PRIME" Marketing Award of Excellence in 1996. He also published *NPN Magazine* and *Fuel Oil News*, covering every sector of the downstream wholesale, commercial, transportation and retail markets.

Mr. Bevers is a member of and actively participates on numerous industry organizations and committees: API/PIDX, SIGMA, NACS/PCATS, PMAA, ILTA, NPECA and MPGA.

gevo™
Renewable Hydrocarbons for the Chemical and Fuel Markets
Top 10
Reasons to use
Isobutanol

Exhibit F

SAFE HARBOR STATEMENT

Certain statements in this presentation, including, without limitation, statements related to Gevo's expected future production capacity, potential market demand, potential for increased margins, potential for reduced volatility, addressable markets, diversified and historically cost-competitive markets, lower carbon footprint, lower risk retrofit, lower cost, minimal downtime retrofit, intellectual property portfolio, feedstock flexibility potential and its ability to produce cellulosic isobutanol once biomass conversion technology is commercially available, may constitute "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. These forward-looking statements are made on the basis of the current beliefs, expectations and assumptions of the management of Gevo and are subject to significant risks and uncertainty. Investors are cautioned not to place undue reliance on any such forward-looking statements. All such forward-looking statements speak only as of the date they are made, and the Company undertakes no obligation to update or revise these statements, whether as a result of new information, future events or otherwise. For a further discussion of risks and uncertainties that could cause actual results to differ from those expressed in these forward-looking statements, as well as risks relating to the business of Gevo in general, see the risk disclosures under the section captioned "Risk Factors" in Gevo's final prospectus related to its initial public offering filed pursuant to Rule 424(b) under the Securities Act of 1933, as amended, on February 9, 2011.

1. A Bridge Between Two Industries

Two Industries: one established, one new

- Downstream Petroleum industry - $500+ billion in transportation fuels assets
- Renewable Fuel industry - $50+ billion

Goal is to better integrate them across the entire fuel value chain:

- Reduce capex by retrofitting existing biochem facilities
- Use existing pipelines to access refineries
- Integrate "drop in" renewable materials into refinery
- Pipeline distribute finished refinery products
- Market products that the customer/consumer wants/needs

Isobutanol has the potential to be that bridge that allows the two industries to become integrated

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2. Evolving Beyond "Food for Fuel"

Feedstock Flexibility

Today

Corn

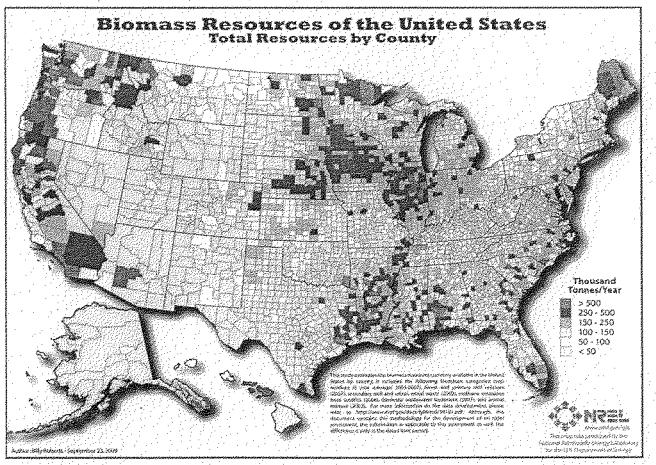
Sugar Cane

Future

Agricultural Residue

Wood

- Initially, Gevo will use cost effective corn starch
- However, our technology can utilize cellulosic sugars
- Ongoing discussions with biomass conversion companies
- Purchase biomass sugar streams when they are ready



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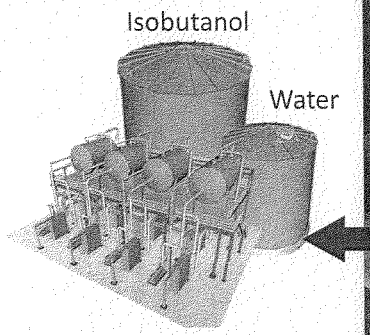
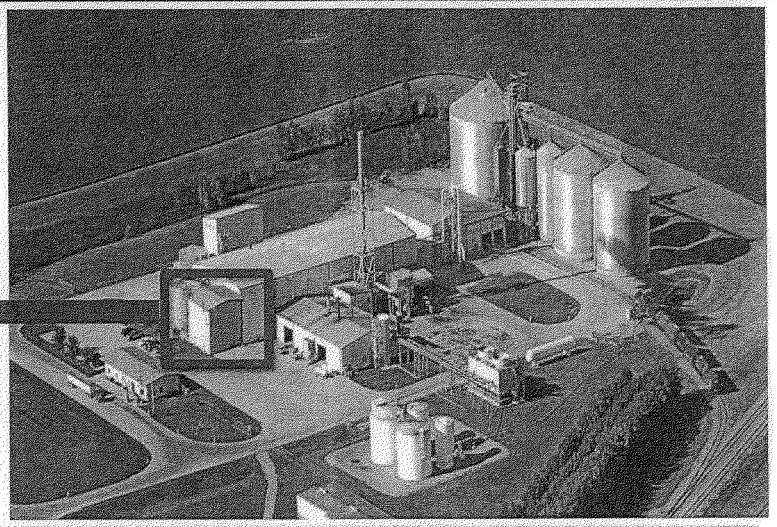
3. Upgrade Existing Biochemical Plants



Gevo's Integrated Fermentation Technology® (GIFT®)



Designed to be Capital Light, Fast Retrofit

Low retrofit costs
~ $0.40/gallon (100 Mgpy)
~ $0.60/gallon (50 Mgpy)

Short construction period
- 11-13 months
- Includes design and engineering

Gevo has not completed a commercial scale retrofit. All costs and construction periods are estimates based on engineering reports from ICM based on information provided by Gevo. We believe all estimates to be accurate.

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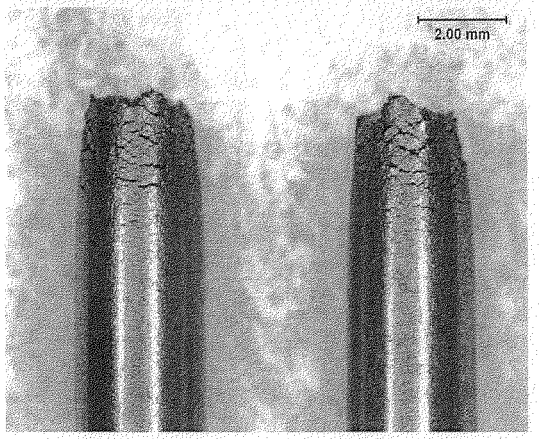
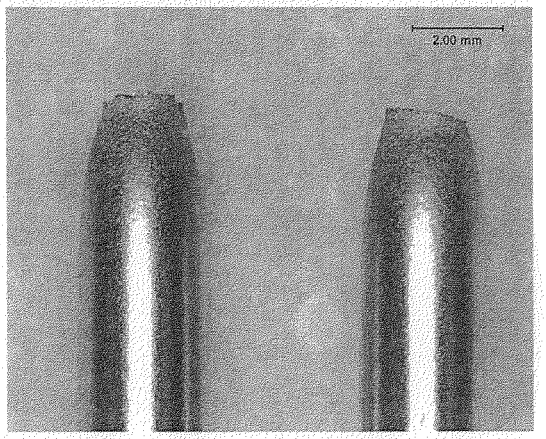
4. Maximize Existing Pipeline Distribution Systems



Stress Corrosion Cracking (SCC)



No Stress Corrosion Cracking (SCC)
(12.5% Isobutanol)

- **Integrity - No SCC or apparent elastomeric compatibility issues**
- **Quality - Ship neat isobutanol and/or isobutanol containing gasoline**
- **Operations – Use NGL and Finished Products pipeline systems**

Gevo has completed preliminary testing with DNV (Det Norske Veritas) on SCC and elastomeric compatibility

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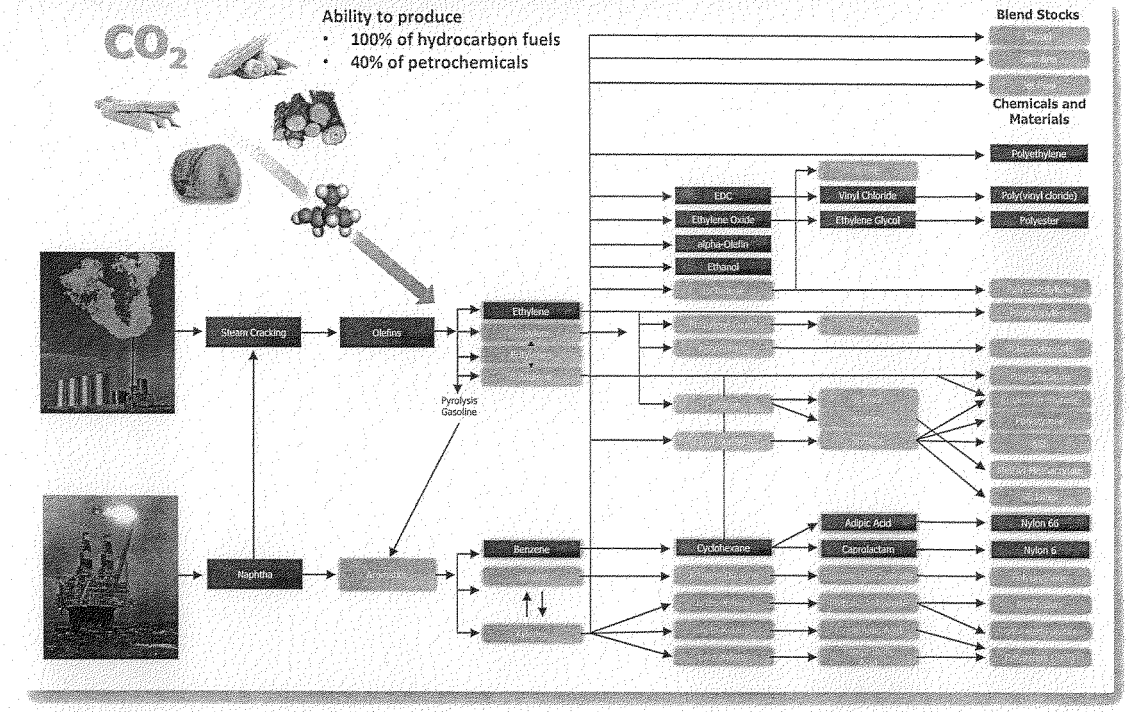
5. Not a "One Trick Pony"



Source: Adapted from Nexant
Note: Chemicals shaded green denote those which can be made from isobutanol-derived building blocks.

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6. Exceptional Gasoline Blendstock

	Ethanol	Isobutanol
Blend RVP	18 - 22 psi (at 10% volume)	4.5 - 5.5 psi (at 12.5% volume)
Blend Octane	112	102
Energy content (% of gasoline)	65%	82%
Water Solubility	Miscible	8.5%
Lower Oxygen Content	35% oxygen	22% oxygen

Potential isobutanol benefits

- **Low volatility allows blending flexibility, optimization**
- **Octane, volatility mix gives better values than alkylate**
- **Higher energy content means higher EISA Equivalence Value and potentially, improved consumer benefits**
- **Limited solubility means the isobutanol stays in the gasoline**
- **Lower oxygen content enables higher renewable volume usage**

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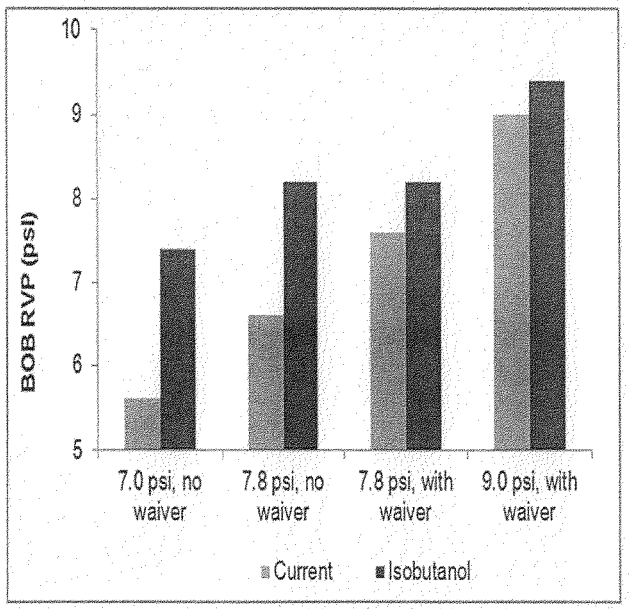
6a. Low volatility – a strategic advantage



- Isobutanol benefits the blending of low cost feedstocks
- Isobutanol's value to the refiner increases as RVP decreases
- Currently, E15 does not have a 1 psi waiver
- Future gasoline volatility may be lowered if the current 75 ppb ozone standard is reduced
- Using isobutanol may mitigate expensive operational refinery upgrades

Source: Analysis via Baker & O'Brien's PRISM model

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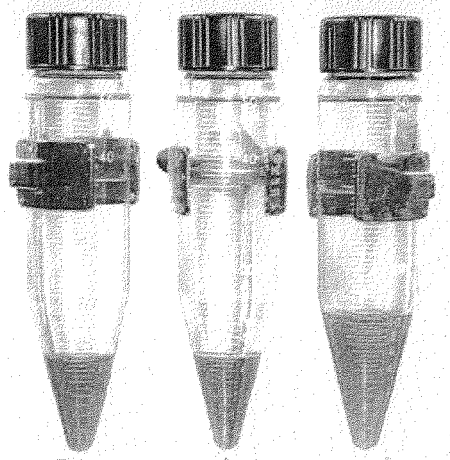
6b. Worried about water?



Gasoline with 10% Water

Isobutanol blended Gasoline with 10% Water

Ethanol blended Gasoline with 10% Water

- Isobutanol acts like a hydrocarbon; it stays in the gasoline
- It has limited ability to attract, absorb, and hold moisture, maintaining the octane integrity of the gasoline
- It is more tolerant to unintended contact with water, even if the volume levels are increased
- There may be lower risk of phase separation in using isobutanol

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6c. Lower Oxygen Content

	Volume in Gasoline	Oxygen Content	RIN-gallons per 100 gallons finished product
E10	10.0%	3.5%	10.00
E15	15.0%	5.2%	15.00
Isobutanol (Substantially similar gasoline)	12.5%	2.7%	16.25
Isobutanol (Octamix or DuPont Waiver)	16.1%	3.5%	20.93
Isobutanol (Waiver to match E15 oxygen content)	24.3%	5.2%	31.39

- Refinery can produce finished products, with a renewable content, that helps them meet their RFS2 obligation
- There may not be a "blend wall" issue with increased RIN-gallon generation rate
- Non-closed loop engine manufacturers have more latitude to accept the gasoline produced
- More time to evaluate and/or evolve engine design to accommodate higher levels of oxygen in gasoline blends

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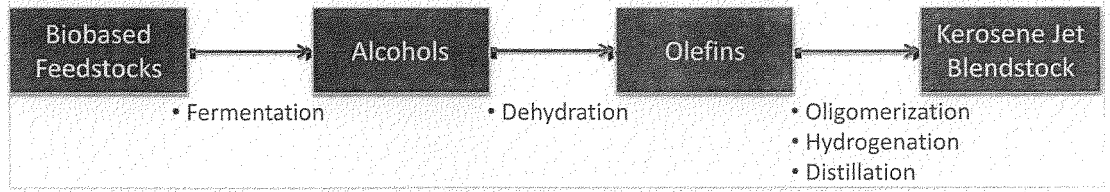
7. Outstanding Jet Blendstock

- Isobutanol to isoparaffinic kerosene (IPK)
  - known conversion unit operations
- IPK
  - may be blended at up to 50:50 mix with petroleum jet
  - has minus 80°C freeze point property
- Relative to EISA, at a projected EV of 1.6, may generate up to 80 RIN-gallons per 100 gallons of finished product
- Airline interest: strategic fuel diversification, emissions reductions, sustainability

Biobased IPK Jet



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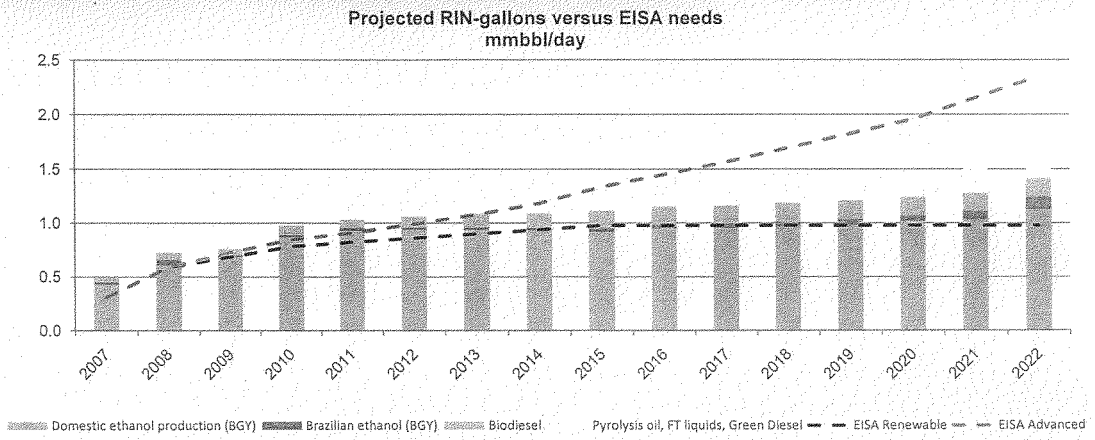
8. EISA



Based on our knowledge of EISA today,

- **Advanced RINs may go significantly short**
- **Isobutanol provides an American made, price competitive "advanced" product, at a high RIN generation rate**

Source EIA AEO 2010 projected renewable volumes, EISA target volumes, Analysis by Gevo

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9. Engaging End User Interest/Support

End User Group involvement

- UL – Isobutanol, at 12.5% by volume, meets ASTM 4814 requirements as a "substantially similar" gasoline
- Auto industry – Proposal for evaluating new fuels/fuel blends
- OPEI/members – discussing test program
- NMMA/members – BRP study, discussing additional test programs
- Retail equipment suppliers – discussing test programs
- ASTM – Sub-committees chartered for isobutanol, isoparaffinic kerosene

No apparent issues; in fact, positive preliminary findings imply isobutanol may address many of the concerns of first generation renewable products

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10. Environmental

Naturally Occuring Material

Isobutanol is a naturally occurring substance, with a musky odor, that is found in many essential oils, foods and beverages (brandy, cider, gin, coffee, cherries, raspberries, blackberries, grapes, apples, hop oil, bread, and Cheddar cheese)

Biodegradability

Isobutanol readily biodegrades in water (360 hrs), soil (360 hrs), and sediment (1,440 hrs)

Toxicology

Isobutanol can be absorbed through the skin, lungs, and GI tract; acute effects are alcoholic intoxication

Compared to other transportation fuel blendstocks, isobutanol is a very good environmental alternative

OECD SIDS Isobutanol Assessment Report – 2004
Anaerobic Biodegradation of Known and Potential Gasoline Oxygenates, University of Oklahoma
US EPA HPV Challenge Robust Summaries and Test Plans (CAS 78-83-1).

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Summary

In using isobutanol, the petroleum industry may be able to effectively roll back the clock 5-15 years to produce fungible, finished products, integrated with renewable materials, that may address regulatory, production, distribution, and marketing issues!

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OECD SIDS Isobutanol Assessment Report – 2004
Anaerobic Biodegradation of Known and Potential Gasoline Oxygenates, University of Oklahoma
US EPA HPV Challenge Robust Summaries and Test Plans (CAS 78-83-1).

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Chairman HARRIS. Thank you very much, Mr. Wasil. Mr. Brown?

STATEMENT OF MR. MIKE BROWN, PRESIDENT, NATIONAL CHICKEN COUNCIL

Mr. BROWN. Good afternoon, Chairman Harris, Congressman Miller, and Members of the Committee. Thank you, Chairman Harris, for the opportunity to participate in today's hearing. Also while unfortunate, I know I appreciate as does Chuck Allen, his family, his growers and employees, your comments regarding their plight. I know the remaining companies on the Eastern Shore appreciate your efforts as they do Mr. Bartlett's efforts this morning before the Small Business Committee on the livestock rules. So thank you.

I am Mike Brown, President of the National Chicken Council. Companies accounting for more than 95 percent of the chicken produced and processed in the United States are members of the National Chicken Council.

The NCC is extremely disappointed and dismayed that the Environmental Protection Agency issued a final approval on June 28, 2011, for new labeling for the sale of gasoline blended with 15 percent ethanol. The E15 gasoline blend is 50 percent greater than the E10 currently sold at most gasoline pumps. Putting aside the very definite and common-sense problem of misfueling that this action will cause, the NCC cannot understand why the Federal Government is taking this untimely and unfortunate step to put more pressure on an already precarious corn crop this fall. A misguided ethanol policy is being further misguided by the rush to placate the corn ethanol interests.

NCC appreciates the 73 Senators who voted last month to begin to stop the madness of full speed ahead for ethanol regardless of the cost or economic fallout on the U.S. economy. The Senators recognized that repealing the VEETC and eliminating the import tariff on foreign ethanol would not just save taxpayers billions of dollars but would also send a message that ethanol manufacturers need to learn to operate in a free-market economy, not a cocoon of government subsidies, mandated usage and insulation from market competition. NCC urges the House to follow suit.

In addition, NCC very much appreciates the 283 House Members who last month voted to approve an amendment that would prohibit USDA from allocating funds for ethanol infrastructure, including blender pumps and storage facilities.

The NCC questions the so-called compromise efforts being debated in Congress to allow the ethanol industry to have its corn and eat it, too. Compromise in NCC's dictionary means that the ethanol industry needs to allow for a good measure of flexibility in the ethanol policy and program going forward. Moving from a tax credit for blenders to a subsidy to build infrastructure is simply dressing up ethanol policy in another dress and is not a compromise.

More specifically, the RFS needs to be subject to an adjustment when market forces and the corn harvest are such that market needs cannot be met at a reasonable cost to users. This is one reason why NCC supports legislation to permit individual States to opt out of corn ethanol portion of the RFS.

The policies and rules of the games for corn-based ethanol must be re-balanced and the playing field must be leveled to permit chicken producers and other animal agriculture producers to more fairly compete for very limited supplies of corn this year and most likely for the next few years. Our companies compete every day in the marketplace, domestically and internationally. We cannot compete with the United States Government.

Broiler companies, since last October when the sudden, unexpectedly run-up in corn and other feed ingredients occurred, have tried to weather the storm of very high, volatile corn prices. But now companies are trimming their production plans, which means growers will receive fewer chicks to grow to market and processing plant shifts will be reduced further affecting employment.

A broiler company in Georgia just announced last week 300 workers will no longer be needed. Also, this month a fourth-generation broiler company in Delaware filed for bankruptcy protection while it works to secure an owner for its assets. Further, another company in Arkansas last week announced plans to consolidate two processing plants as well as two hatcheries. This consolidation will result in additional 223 jobs being eliminated. The company in its announcement indicated that eliminating these jobs will give it a better chance to survive.

I would like to tell this Committee that this downsizing is the end of the boiler industry's financial problems, but I cannot tell you that because there are a number of other companies on the financial bubble. Banks and other lending institutions are telling these companies, enough is enough, meaning sell your assets and repay your outstanding debt. What some analysts say about the broiler industry of ten companies in ten years may become a reality much, much sooner.

The NCC strongly supports legislation that the Subcommittee asked for our views on that would require the Administrator of the EPA to contract with the National Academy of Sciences to conduct a comprehensive assessment on the ramifications of the use of ethanol blends. Chicken companies and all of animal agriculture are bearing the burden and feeling the disastrous effects of competing for corn on a field that is heavily tilted toward the ethanol industry.

Mr. Chairman, I have submitted more in-depth testimony, and I will conclude my remarks here. Thank you.

[The prepared statement of Mr. Brown follows:]

PREPARED STATEMENT OF MR. MIKE BROWN, PRESIDENT, NATIONAL CHICKEN COUNCIL

Good afternoon, Chairman Harris, Congressman Miller, and Members of the Subcommittee. Thank you, Chairman Harris, for the opportunity to participate in this important and very timely hearing on the issues impacting poultry companies, farmers, and the allied industry that supplies the necessary goods and services to the poultry business.

I am Mike Brown, President of the National Chicken Council. Companies accounting for more than 95 percent of the chicken produced and processed in the United States are members of the National Chicken Council.

E15 Labeling Permitted

The National Chicken Council is extremely disappointed and dismayed that the Environmental Protection Agency issued final approval on June 28, 2011 for new labeling for the sale of gasoline blended with 15 percent ethanol. This E15 gasoline

blend is 50 percent greater than the E10 currently sold at most gasoline pumps. Putting aside the very definite and common sense problem of misfueling that this action will cause, the National Chicken Council cannot understand why the federal government is taking this untimely and unfortunate step to put more pressure on an already precarious corn crop this Fall. A misguided ethanol policy is being further misguided by the rush to placate the corn ethanol interests. When will the Administration begin to recognize that blindly pursuing this type of policy is financially damaging consumer pocketbooks and causing taxpayers to pay for a policy that makes little, if any, economic sense?

Some In Congress Understand

The National Chicken Council appreciates the 73 Senators who voted last month to begin to stop the madness of full speed ahead for ethanol regardless of the cost or economic fallout on the U.S. economy. The Senators recognized that repealing the Volumetric Ethanol Excise Tax Credit (VEETC) and eliminating the import tariff on foreign ethanol would not just save taxpayers billions of dollars but would also send a message that ethanol manufacturers need to learn to operate in a free market economy, not a cocoon of government subsidies, mandated usage, and insulation from market competition. Also last month, similar legislation was introduced in the House and the National Chicken Council also strongly supports this House effort.

The National Chicken Council very much appreciates the 283 House Members who last month voted to approve an amendment that would prohibit USDA from allocating funds for ethanol infrastructure, including blender pumps and storage facilities. It is important to note that the latest vote on this legislation received 22 more votes than it did when originally passed by the House in February. This message is becoming increasingly clear that more and more Congress are recognizing that the ethanol industry must, after more than 30 years, begin to compete on a level field in the marketplace.

Compromise Is Not A Compromise

The National Chicken Council questions the so-called compromise efforts being debated in Congress to allow the ethanol industry to have its corn and eat it, too. Compromise in the National Chicken Council's dictionary means that the ethanol industry needs to allow for a good measure of flexibility in the ethanol policy and program going forward. Dressing-up ethanol policy in another dress is not a compromise. More specifically, the Renewable Fuels Standard (RFS) needs to be subject to an adjustment when market forces and the corn harvest are such that all market needs cannot be met at a reasonable cost to users. That is one reason why the National Chicken Council supports proposed legislation to permit individual states to opt out of the corn ethanol portion of the RFS. This common sense approach would be a good policy, especially when there is a very limited supply of corn available at a reasonable cost. States under this type of legislation can determine for themselves the trade-off of higher food costs versus more gasoline blended with ethanol. Allowing states to make this critical call is a step toward taxpayers and consumers better deciding for themselves what is in their best interest. The National Chicken Council calls upon Congress and others involved to permit states this opportunity. There are, of course, other reasonable approaches to adjusting the RFS when the conditions so dictate.

Corn-Based Ethanol Policies And Rules Need Re-Alignment ASAP

The policies and rules of the games for corn-based ethanol must be re-balanced and the playing field must be leveled to permit chicken producers and other animal agriculture producers to more fairly compete for the very limited supplies of corn this year and most likely for the next few years. This action must be taken as-soon-as-possible. Broiler companies, since last October when the sudden, unexpectedly run-up in corn and other feed ingredient costs occurred, have tried to weather the storm of very high, very volatile corn prices. But, now, companies can no longer withstand the storm. Companies are trimming their production plans, which means growers will receive fewer chicks to grow to market-ready broilers and processing plant work shifts are being reduced or even eliminated. With less work time, more and more workers are being laid-off. A broiler company in Georgia just announced 300 workers will no longer be needed. Also, this month a fourth-generation family broiler company in Delaware filed for bankruptcy protection while it works to secure another owner for its assets. Further, another company in Arkansas last week announced plans to consolidate two processing plant operations into one location and similarly will combine two hatcheries into a single facility. This consolidation will result in 223 jobs being eliminated. The company in its announcement indicated that eliminating these jobs will give it a better chance to survive. Earlier in 2011 this same company eliminated about 300 jobs in an attempt to stay in operation.

Also, in May this year, a third-generation broiler company with a complex in North Carolina and another complex in Arkansas succumbed to the financial stress of high feed costs. The result in this case is that its complex in North Carolina is now owned by a foreign company and the Arkansas complex is now owned by another broiler company that not only had the borrowing capacity to purchase the assets but the reserves that will undoubtedly be necessary to carry financial loses until the broiler market improves to at least a breakeven position. A third-generation company in Mississippi closed its doors earlier this year as the corn cost/chicken price squeeze became intolerable.

I would like to tell this Committee that the above noted situations are the end of the broiler industry's financial problems. I cannot tell you that conclusion because there are a number of other companies on the financial bubble. Banks and other lending institutions are telling these companies, "enough is enough," meaning sell your assets and repay your outstanding debt. What some analysts say about the broiler industry of "ten companies in ten years" may become a reality, and perhaps, sooner than in a decade.

Draft Legislation For NAS Study On E15

The National Chicken Council strongly supports legislation that would require the Administrator of the Environmental Protection Agency to contract with the National Academy of Sciences to conduct a comprehensive assessment on the ramifications of the use of mid-level ethanol blends, meaning any blend level above E-10. NCC supports research comparing ethanol-gasoline blends containing 15 percent ethanol with ethanol-gasoline blends containing 10 percent. Chicken companies and all of animal agriculture are bearing the burden and feeling the disastrous effects of competing for corn on a field that is heavily tilted toward the ethanol industry. NCC urges this Committee and others in Congress to move quickly to approve the draft legislation for an impartial, science-based study. Such a study will help document the folly of hiking the ethanol blend in question when there is not enough corn in the foreseeable future to even meet the needs of E10.

Conclusion

The National Chicken Council, its members, and the many allied industry companies that support poultry production, processing and marketing look forward to working more closely with the Committee and others in Congress so that poultry producers have a better opportunity to successfully manage the increasingly difficult challenges and issues. Improving the state of the poultry industry not only helps poultry companies and poultry farmers but, more importantly will allow consumers of poultry products to continue to enjoy an ongoing, adequate supply of animal protein at reasonable prices.

I look forward to your questions and comments.

Biographical Sketch of Mike Brown, President, National Chicken Council

Mike Brown is president of the National Chicken Council. He was selected for this position in February 2011, succeeding George Watts. As president, Brown manages the NCC staff and is responsible for carrying out policies as determined by the Board of Directors.

Previously, Brown was on the staff of the American Meat Institute, where he represented AMI to Congress and the Administration as the organization's senior vice president for legislative affairs. He joined AMI in May 1995, after serving eight years as a legislative assistant for former Sen. John Warner (R-VA), focusing on agriculture, food safety, labor, immigration, environment, and international trade issues. Brown also previously worked as a legal publication specialist for the Federal Register, where he was responsible for providing information to Congress, federal agencies, trade associations and others on federal regulations and office programs and publications.

Brown earned his Bachelor of Science in political science and history from the State University of New York, Brockport. Brown and his wife, Kelly, live in Vienna, Virginia.

The National Chicken Council represents vertically-integrated chicken producer-processors, the companies that produce, process and market chickens and chicken products. Member companies of NCC account for more than 95 percent of the chicken sold in the United States.

Chairman HARRIS. Thank you very much, Mr. Brown. Mr. Burke?

STATEMENT OF MR. W. STEVEN BURKE, PRESIDENT AND CEO, BIOFUELS CENTER OF NORTH CAROLINA

Mr. BURKE. Mr. Harris, Mr. Miller, Members, the Biofuels Center of North Carolina was established by our legislature in 2007 to implement a long-term state policy goal, to gain large internal capacity for alternatives to petroleum-based liquid fuels.

I have been asked today to explicate our thinking, not to provide technical E15 responses. I offer, however, a simple statement about the E15 decision. Assuming technical concerns can be addressed, the Biofuels Center supports it as a necessary intermediate step on the road to this Nation's larger goals for advanced biofuels. More time is needed for their development. In the interim, increased ethanol use, ethanol not necessarily entirely made from corn, catalyzes new technology, affirms economic and environmental benefits and prepares us for the next large amounts of generational feedstocks and facilities.

Biofuels development in North Carolina is shaped by a realistic premise: America will continue to seek more augmentation of petroleum-based liquid fuels and thus needs new State models to gain large amounts of liquid fuel from sources other than corn in places other than our Midwestern States.

North Carolina sprang from a bold goal. By 2017, we seek to gain ten percent of our State's liquid transportation fuels from biofuels grown and produced in North Carolina, 600 million gallons are estimated to be required.

Appropriation and policy port for this goal is sustained and nonpartisan. Biofuels is judged a matter of shared future-thinking policy.

How does the State create the disciplined framework for a complicated long-term new sector? The question is important, for States should assume increasing leadership in bringing biofuels to our national landscape.

North Carolina's nationally unique biofuels endeavor is shaped by six imperatives. Imperative one, by policy that biofuels endeavor is not based on corn-derived ethanol. Judged unusual when laid out in 2007, the decision has proven smart. North Carolina does not efficiently produce corn and our large animal sectors must not be disadvantaged. As such, other crop and tree-based feedstocks must be developed. Energy, grasses and wood will likely be dominant.

Imperative two, biofuels must be seen and shaped as a technology. Despite large production of ethanol in the mid-west and in Brazil, the technology is nascent and unfolding, at an early stage comparable to main-frame computers. Current corn-based ethanol production displays the historical reality of technologies. They begin with what we know and with what we can do and then evolve. Such evolution will yield new ways to make fuels from new sources in more places.

Imperative three, a comprehensive approach is required for piecemeal attention yields uncertain success in technology development. A dovetailed approach addresses every aspect of biofuels, science, growing, pilot and large scale production, company devel-

opment, distribution, training, land, biomass, financing, environment, policy issues, public preparation.

Imperative four, the endeavor for biofuels is civic in scale and responsibility. As biofuels affects the largest components of our society, science, technology, agriculture and growers, crops, forests, policy, strategy, public choices, cars, car culture, land, energy, economic gain, production, distribution, environments, sustainability, jobs, daily life and in fact, every one of us, civic is at hand.

Imperative five, economic and agricultural sustainability of crop and tree-based resources over time must be ensured for national feedstock requirements will be enormous and unprecedented.

Imperative six, innovative targeted projects are required. Three representative examples are under way in North Carolina's biofuels endeavor. One, North Carolina's biofuels campus, a 426-acre campus will be developed over the next ten years as the Nation's only large site for growing company development, public engagement and demonstration. Two, use of swine lagoon spray fields. North Carolina's swine industry yields lagoon affluence sprayed for remediation on 100,000 acres growing low-value coastal Bermuda grass. The Biofuel Center has trials under way to verify environmental and economic benefits to instead grow cellulosic energy grasses, sorghums, switchgrass, miscanthus, and Arundo donax.

Project Eastern Gain. We seek by 2016 to gain 50 million gallons of jet aviation fuel from our land contiguous to bases.

I appreciate the opportunity.

[The prepared statement of Mr. Burke follows:]

PREPARED STATEMENT OF MR. W. STEVEN BURKE, PRESIDENT AND CEO, BIOFUELS CENTER OF NORTH CAROLINA

Mr. Chairman and Committee Members: I am Steven Burke, President and CEO of the Biofuels Center of North Carolina. A private non-profit corporation, the Center was established by the North Carolina Legislature in 2007 to implement a policy, economic, and agricultural imperative: to gain large internal capacity for alternatives to petroleum-based liquid fuels.

I have been asked not to provide technical responses about E15 but, instead, North Carolina's way of thinking and a way of doing about our biofuels future.

I briefly make, however, a simple statement about the E15 decision of the EPA. The Biofuels Center supports the decision as a necessary intermediate step on the road to larger and longer-term national goals. More time is clearly needed for advanced biofuels technologies to develop. In the interim, increased use of ethanol serves as the first stage foundation required for new biofuels technology, affirms biofuels within consumer and national life, and prepares for large amounts of next generation feedstocks, technology, and facilities.

For biofuels development in North Carolina, my requested topic, our way of thinking and doing is shaped by a strong premise: *America will continue to seek more augmentation of petroleum-based fuels and thus needs new models to gain large amounts of liquid fuel from sources other than corn in places other than the Midwest.*

North Carolina has shaped such a model, springing from an ambitious goal: *by 2017, 10% of the state's liquid transportation fuels will come from biofuels grown and produced internally.* By current usage estimates, up to 600M gallons will be required.

The goal is challenging but possible if a key recognition underlies policy and activities: development of large biofuels capacity must be seen as landscape changing, actually and figuratively, and as such must be judged nothing less than a societal and civic imperative.

Such thinking, both bold and common-sensical, shapes work of the Biofuels Center of North Carolina. Judged the nation's only agency working comprehensively over time for all aspects of biofuels development, it was established to meet the state goal and shape a 10–15 year civic endeavor statewide. The endeavor sprang from four compelling and strong imperatives:

1. Smart places and leaders now must strategically address their energy future as crucial for their future success and daily survival.

2. An enormous and feasible new sector, well dovetailed to a state strong in both agriculture and technology, will be created.

3. Economic and societal gains will come across the state, largely in rural and agricultural counties most in need of economic advantage. Realistic opportunities for sustained rural gain are few and merit committed support.

4. Job and economic enrichment will be as strong or stronger in existing areas—forestry, agriculture, logistics, and distribution—as in new production facilities.

Financial and policy support for North Carolina's biofuels endeavor is sustained, permanent within the budget even at a time of financial constraint, and consistently nonpartisan. Biofuels in North Carolina is judged a matter of thoughtful future-thinking policy and not of politics.

The Center is located on North Carolina's Biofuels Campus, in the Granville County town of Oxford. The 426-acre Campus is a former lead USDA Tobacco Research Station established in 1910 and turned over to the state in 2005. The movement from tobacco to biofuels nicely symbolizes evolutionary changes in state and national agriculture.

How does a single state create and implement the long-term, disciplined, and comprehensive framework required to create and maintain a complicated new sector? Our thinking is shaped under two headings:

- NORTH CAROLINA'S NATIONALLY UNIQUE BIOFUELS ENDEAVOR
- CONSIDERED THINKING ABOUT POLICIES, MANDATES, AND SUPPORT

North Carolina's Nationally Unique Biofuels Endeavor

Shaped by the Biofuels Center of North Carolina, a statewide framework will over time strengthen resources, gain both feedstocks and production facilities, minimize risk and maximize gain to growers and investors, and address attendant financial, environmental, and policy issues.

Ten factors and recognitions shape North Carolina's approach to biofuels development:

1. An Endeavor Not Based on Corn

By policy, North Carolina's state biofuels endeavor will not be based on or develop corn-derived ethanol. Judged an unusual determination when laid out in 2007, the decision has been proven sound. It grants realistically that the state does not efficiently produce corn and that large poultry and swine industries must not be disadvantaged.

As such, state policy must soon and strongly move to practical evidence that other feedstocks, both crop- and tree-based, can sustainably and economically support advanced cellulosic biofuels. While this will make large commercial production unlikely in the short-term, it will yield strong advantage and good preparation for the longer-term as America moves to other feedstocks and more producing states.

2. Biofuels Development is Technology Development

Biofuels must be seen and shaped as a technology—demanding and complicated, exploratory and entrepreneurial. Despite large production of ethanol in the mid-west and Brazil, the technology is new and unfolding, at an early stage comparable to main-frame computers. Such ethanol production displays the historical reality of technologies: they begin with what we know and can do, and inevitably evolve. Such evolution will in coming years yield new ways to make fuels from new sources in new places.

As with any new technology, gaining such new biofuels will take time, prove expensive, yield risks and setbacks, and necessarily require problem-solving. As technologies must, the imperative will engage our best thinking, arouse entrepreneurial imagination, trigger new governmental programs and policies, yield large economic return, force leadership, and make the place better. Although based on agriculture—the first technology around which societies formed—advanced biofuels are as technologically complex as the devices in our pockets. Failure to understand this complexity lessens the speed and effectiveness with which programs and funding move biofuels along the process of technology development, from societal need and research to outcome and change.

3. The Endeavor is Agricultural

Human life has been shaped by dependency upon the land—for food, key materials, and energy. Although the last century was shaped by non-land based energy sources for most vehicular transportation, common sense and strategic reality now impel movement from total dependency on carbon-emitting, variably available, and

politically destabilizing petroleum. Costly to America by many measures, that about-to-end-era freed the land unrealistically and only temporarily from its place in energy production.

Agriculture and the land are, so to speak, back . . .and indeed strengthened . . .for energy production. Both must provide expanding capacities to fuel our vehicles as well as our diets and materials for daily life. Responsible state biofuels programs grant that accommodating new feedstocks to land, in balance with both food uses and the environment, requires challenging new thinking and policies.

4. A Comprehensive Approach is Required

North Carolina's approach to biofuels development is comprehensive, based on the recognition that piecemeal attention to resources and tasks yields uncertain success. A dovetailed framework of strategy and activities must integrate every aspect of biofuels, from societal policy to new fuels enthusiastically placed in vehicles.

The nation's only state-based agency constituted with a comprehensive mandate, the Center addresses over time: research, growing and agronomic analysis, pilot and large scale production, company development, distribution, land and land use, environmental and policy issues, and public preparation.

Specific requirements are varied: farmers and landowners must commit to new feedstocks and new uses of biomass; economic analyses must verify that money can be made in growing, production, and distribution; consequential issues must be addressed, for large impact will be seen on land, biodiversity, water, and the environment. Credibly addressing issues will in fact likely prove crucial in coming years to sustained growth of the biofuels sector; addressing them is a responsibility as well as the task of a life-based technology. Problems must be solved; models for sustainability must be crafted.

While few would argue that these are the tasks of biofuels development, no other federal or state models appear to purposefully identify, fund, and address them in a comprehensive framework. Encouraging such state and regional models can prove valuable to this Subcommittee and to federal agencies, as they will increasingly prove necessary for the success and survival of a national biofuels endeavor expanding in feedstocks, geography, and strategic importance.

5. Sustained Commitment is Required

North Carolina grants that a long-term commitment is required. Technologies, a landscape changing sector, and visionary goals do not come about quickly or easily. As such, a sustained endeavor, over 15 plus years, will yield daunting tasks and developing groundwork in the short term but verifiable and large return in the long-term.

6. The Endeavor is Civic in Scale and Responsibility

Biofuels both springs from and shapes many of the largest societal imperatives: science and technology, agriculture and growers, crops and forests, policy and strategy, public behaviors and car culture, land and land use, energy and comprehensive energy policy, economic gain, production and distribution, climate, verified and functional sustainability, and something of daily survival in a changing world. As such, biofuels is nothing less than a civic endeavor. Smart places, agencies, and policy leaders should include it among imperatives for deliberate civic attention. Synthesis among the imperatives is challenging but required. As with any civic and societal mandate, the key framing question is constant and large: how can this endeavor make better our place and our future?

7. Production at Varying Scales is Sought

Biofuels, particularly biodiesel, can be produced at widely varying scales by widely varying producers. No other significant technology permits such variation from small to large, from local and civic sources to 100M gallons per year commercial facilities. Granting that biofuels can and should fully spring from every feedstock source and possible facility, North Carolina posits a future landscape peppered with sites varying in output and sources. Gains to municipalities, consortia, landfills, farmers, and landowners will augment large commercial gains. A balance of local and centralized biofuels production simultaneously serves strategy, common sense, and community economies.

8. Feedstocks and Biomass Must be Sustainable

Sustainability of varied crop- and tree-based resources over time must be ensured, for the feedstock requirements and drawdown in coming years—particularly if petroleum is constrained more quickly than expected—will be enormous and unprecedented in North Carolina and beyond. Environmental, agricultural, and economic imperatives must be simultaneously served and balanced. While farmers are accustomed at thinking in such terms, not all parties seeing gain from biofuels necessarily will be, particularly in the short-term.

9. The Imperative is Unquestioned

Smart places and leaders understand now that gaining alternatives to petroleum-based fuels is not just desirable, not a luxury, and not just a useful addition to the agricultural sector. Biofuels are requisite for our future. Our best problem-solving and most targeted programs must be shaped to ensure their availability and benefit. More challenging yet, biofuels must be shaped within the full context of comprehensive energy policy, for in our era no source or new mandate can exist in isolation. Doing so proves challenging to states as to the federal government.

10. Innovative Partnerships and Targeted Projects are Required

Creating enormous amounts of new fuels from more places with expanding agriculture and new technology is unlikely without new thinking and activities. In any place, goals must be matched with resources and activities and must fit a comprehensive framework. Four representative examples, each complex and large in ambition, are underway in North Carolina:

North Carolina's Biofuels Campus

The 426 acre Campus will be developed over the next ten years as the nation's only large site for:

1. Trial growing and agronomic data for crops and trees, both indoors and in greenhouses.
2. Company incubation and partnerships. A recently completed business accelerator, with lab renovation funded by the DOE, provides a setting for small company development.
3. Pilot and demonstration facilities.
4. Public education and multiparty convenings on the biofuels issues, financing, and technology.

Use of Swine Lagoon Sprayfields

North Carolina's large swine industry yields lagoons containing nitrogen and phosphorus. Excess liquid is routinely sprayed on 100,000 acres of prime fields currently growing low-yield and low-value Coastal Bermuda grass only to absorb and remediate these effluents. The Biofuels Center has trials underway to verify both environmental and economic benefits to instead grow cellulosic energy grasses: sorghums, switchgrass, miscanthus, and Arundo donax. Multiple commercial and proximal production facilities can be supported from the feedstocks; benefits will accrue nicely for both animal and crop agriculture as well as rural for regional economic gain.

Assessment of Wood Resources Statewide

North Carolina's 18M acres of forested land proves compelling to technology and production companies working for conversion of privately owned wood biomass, for the amount can balance both feedstock needs and sustainability over years. The Biofuels Center will soon complete analysis of wood resources statewide and of 14+ sites for production facilities. Doing so is necessary to enable production companies to economically sustain new wood-based technologies and justify large investment.

Project Eastern Gain

Home to the nation's third largest military presence, from all branches, North Carolina seeks to both strategically serve the military and to prevent encroachment on its bases. An ambitious project seeks by 2016 to gain up to 50M gallons of jet aviation fuel from new land use and new production facilities in rural counties contiguous to bases.

Considered Thinking About Policies, Mandates, And Support

Ultimately in our society, government policies, leadership at all levels, smart thinking, and best outcomes work for only two profound goals: societal improvement and survival. As areas of societal improvement become larger in impact, more complex in implications, and change-inducing, governments assume inevitable responsibility to guide and trigger. Biofuels, as well as the larger imperative of sustainable energy of all types, should be judged necessarily worthy of governmental attention and mandate. For biofuels—as for any new endeavor, new technology, or new policy—the shaping of appropriate attention and mandate is challenging, evolving, and difficult.

To ensure national biofuels capabilities, federal agencies and some state governments have shaped programs, set goals, and committed funding. Doing so gives verification of need as well as impetus for new biofuels capabilities, resources, and policies—from science and technology to production facilities, consumer choices, and agricultural foundations. Important and complex societal outcomes seldom just hap-

pen anymore by fate and good intentions. Inducement, support, and nurturance are required. Leadership is necessary to induce change and gain.

For the federal government in particular, large in both responsibility and resources, two enormous key questions soon emerge around such attention to biofuels:

First, how is the always uneven balance between goals, public outcomes, and technology development addressed? Policies and questions around ethanol reveal this inevitable initial disjuncture. Moving to larger ethanol usage, as discussed in this hearing, moves national goals to quantifiable reality; doing so is always hard and always welcome. At the same time, the goal impels change to both industry and the public. The juncture of goals, new technology, and an existing industry is historically never smooth and biofuels development proves no exception.

As a result, the proposed assessment of effects of mid-level ethanol blends discussed today is neither surprising nor unwelcome. If quantifiable results and concerns reveal new needs or liabilities, the continual imperative of new technology development is simply at hand and affirmed: address and solve the problem. That is what technologies do as they find their place and merge with existing industries. Failure to do so with ethanol would surely be akin to truncating mobile phones development because they early dropped calls. Technologies always yield challenges and outcomes in equal measure. Economic, policy, industry, and public factors are always at play and must be balanced, with risk usually at hand if one vantage point is allowed to dominate decisions.

Second, how do we evaluate the cusp at which a new technology or sector, like any offspring, needs to be weaned of nurturance? The movement from necessary nurturance to ongoing subsidy seems often subtle and too-inevitable. A technology too-long subsidized is at best expensive as well harder to defend, and seems at worst the boutique captive of vested interests. No sector truly important to society, as is true of biofuels, can be seen fairly or not as supporting vested rather than societal interests. Current analyses of ethanol subsidies reveal the inevitability of addressing this cusp.

At the same time, other federal programs and mandates—for loan guarantees of production facilities, for verification of new technologies, for gaining of biomass, for production and use of ethanol—appropriately continue still-early nurturance of goals and infrastructure. However, they will necessarily evolve as a strengthened and expanding biofuels community nationwide moves to new needs in coming years.

BIOGRAPHY FOR W. STEVEN BURKE, PRESIDENT AND CEO, BIOFUELS CENTER OF NORTH CAROLINA

Mr. Burke has served as president and CEO of the Biofuels Center of North Carolina since March of 2009. He served as founding board chair from July of 2007 until that date, and as acting president since August 2008.

The Biofuels Center is a private, non-profit corporation established by the State of North Carolina to implement a policy commitment to gain large capacity for growth and production of biofuels. The Center is judged the nation's only agency working within a long-term and comprehensive framework for all aspects of biofuels development.

Mr. Burke serves on the Executive Committee of the Biofuels Center. He is a member of the State of North Carolina's Energy Policy Council; a board member of the Bent Creek Institute; and Vice Chair of the board of directors of the Biotechnology Institute, a non-profit corporation working for strengthened biotechnology education nationwide. From 2001–2009, he served as founding board chair and board member of the Institute of Forest Biotechnology, a private non-profit corporation addressing the scientific, industry, and societal issues of forest biotechnology worldwide. He served two terms—in 1995–96 and 1997–98—as chair of the 100+ member Council of Biotechnology Centers of BIO, the Biotechnology Industry Organization, and served on the Council's Board from 1993–2000. He served from 1994 until June of 1999 on the Emerging Companies Section Governing Board of BIO.

Mr. Burke has been an active participant in the national and international life science and biotechnology communities since the mid-1980s. He speaks throughout the United States and internationally on life science technology development, with particular attention to:

- The policies, issues, and development of biofuels
- The factors, strategies, and issues shaping effective biotechnology and life science communities
- The international and cultural imperatives of biotechnology development

Mr. Burke departed the North Carolina Biotechnology Center in 2009 as senior vice president for corporate affairs. Over 24 years, he helped shape the approach and strategies of the Center, the world's first targeted initiative for biotechnology development. He was responsible for varied activities and programs addressing strategic, governmental, policy, societal, and international issues. Among key outcomes: oversight of Growing North Carolina's AgBiotech Landscape, shaping multi-party long-term state vision; development of a nationally unique program to strengthen niche biotechnology through five regional offices across North Carolina; development with partners of North Carolina's Strategic Plan for Biofuels Leadership and the Biofuels Center of North Carolina; activities and policy recommendations shaping forest biotechnology and establishing the Institute of Forest Biotechnology; envisioning and establishing with partners the Bent Creek Institute, working in western North Carolina at the juncture of biotechnology with native plants; and a collaborative relationship with the German state of North Rhine–Westphalia. Prior to joining the North Carolina Biotechnology Center in 1985 as its fifth employee, Mr. Burke taught Instructional Design at North Carolina State University in Raleigh, North Carolina. He has an undergraduate degree in Religion and Literature from Duke University, and a Master of Education in Instructional Design from the University of North Carolina at Chapel Hill. He owns, curates, and informs about the nation's largest collection of American folk art buildings.

Chairman HARRIS. Thank you very much, Mr. Burke. I now recognize our final witness, Dr. Ron Sahu testifying on behalf of the Outdoor Power Equipment Institute.

STATEMENT OF DR. RON SAHU, TECHNICAL CONSULTANT, OUTDOOR POWER EQUIPMENT INSTITUTE

Mr. SAHU. Good afternoon, Chairman Harris, Ranking Member Miller and other Members of the Committee.

Chairman HARRIS. I think you have to turn your microphone on because we are being recorded.

Mr. SAHU. Oh, I will use this one instead. Thank you.

Thank you again for the opportunity to appear. I am an independent technical consultant as the Chair noted in introductions. I have a Bachelor's and Master's and Ph.D. in Mechanical Engineering, the latter two from CalTech.

Since about 2005, I have been looking at the impact of what is commonly called mid-level ethanol blends in the fuel mix on a variety of equipment. It began with the effort in Minnesota, and ever since that time and in the years pursuant, I have done extensive research on almost every aspect of the fuel impact on equipment.

I am not going to repeat much of what I heard from the other panelists in the interest of time, and going last I have that advantage. So I am going to hit some of the points that were not made or could not be made because of time.

Let me give you a scale of this potential problem. I understand EPA's waiver decision is limited to automobiles and late-model automobiles. Even assuming that those automobiles are perfectly capable of handling E15, that still leaves us with a potential problem. And there may be reason to believe that that universe is still likely to be impacted negatively.

There are collectively around 500 million pieces of equipment in this country, legacy equipment, that are already out there, everything from boats and cars, including outdoor equipment. Much of that equipment is incapable of adaptive technology to handle new fuels, so it is out there. Much of it cannot be tracked.

We estimate a replacement value north of $2 trillion for that universe. This group is going to be drinking gasoline so to speak from

the same pool that the automobiles drink, so there is no way to separate the fuel pool unless designed by regulation. Although there are so many pieces of equipment as a percent user of gasoline, the non-road sector is a relatively small percentage. So there is little incentive for dispensers to create separate infrastructure to support this large- or small-volume user group.

But let us not confuse that with the risk and harm. The harm and risk is not proportional to the volume of the market. This is a technical hearing. Let me point to some critical things we have learned I think universally from the Department of Energy studies, State of Minnesota work, independent work that industry has done.

Ethanol increased to E15 will cause increased temperatures, exhaust temperatures and equipment temperatures. A lot of equipment is used close to the operators. If you see people operating a chain saw or a blower, it is next to their person. The inability to handle high amounts of heat properly without sustaining burns is a critical safety issue.

Increased temperatures will also affect material usage and deterioration, including rubbers, elastamers, plastics, variety of metals that are used in the equipment that is already out there.

Increased permeation and other evaporative emissions will also result.

And another safety issue is inadvertent misoperation of equipment. Take chainsaw, for example. If a chainsaw starts to engage, the clutch engages at a different rotational speed before the operator expects it to, you can only imagine the catastrophic consequences. And that is one of the findings of the DOE study is unintentional clutch engagement of that type of close and hard-bladed equipment.

We appreciate the dilemma that EPA had in making its regulatory decision. We certainly do. But in spite of asking for a sound and tough label that would provide some measure of separation in this common pool, EPA declined to provide a strong label. We do not think the label proposed is at all going to serve the need to segregate or warn people. In fact, it is an attention label, not even a warning label.

And as a fellow panelist noted, EPA has declined to mandate the availability of E10 for this large universe, which means misfueling is a strong possibility.

I would urge the Committee in its National Academy of Science study to expand the scope specifically with regards to two items, one, to expand the work that they need to do to look at implications of compatibility issues, higher temperatures and safety. The second is they should critically examine the issue of misfueling because misfueling is a very complex issue, and they should go beyond labels and look at all the other ways in which a more sound barrier can be provided between a waiver that applies to a portion of the population and not to the others.

I will be happy to answer any questions that the Committee may have later. Thank you.

[The prepared statement of Dr. Sahu follows:]

PREPARED STATEMENT OF DR. RON SAHU, TECHNICAL CONSULTANT, OUTDOOR POWER EQUIPMENT INSTITUTE

Good afternoon Chairman Harris, Ranking Member Miller and Members of the Committee. Thank you for the opportunity to appear.

INTRODUCTION

My name is Ron Sahu. I am an independent technical consultant. I am representing myself as well as members of the Outdoor Power Equipment Institute (OPEI), a trade association whose members make a wide range of outdoor power equipment, including lawn and garden equipment.

I have provided my curriculum vitae to the Subcommittee as requested (Attachment I). Briefly, I have a Batchelor's degree in Mechanical Engineering from the Indian Institute of Technology (IIT); followed by Masters and Ph.D degrees, also in Mechanical Engineering, the latter with an emphasis in combustion, from the California Institute of Technology (Caltech), in Pasadena, CA. I am also adjunct faculty at a number of local universities including UCLA. And, I have served as expert witness for the EPA on Clean Air Act matters.

MID-LEVEL ETHANOL AND ITS IMPACTS ON ENGINE AND EQUIPMENT

As the Committee may be aware, all current engines and equipment sold and operated in the US, collectively a universe of over 500 million legacy products valued at around 2 trillion dollars, that rely on motor gasoline as fuel, can handle up to 10% ethanol as part of the gasoline. Many auto manufacturers have also designed cars that can run on E85, which contains 85% ethanol. I am not aware of any non-automotive or non-road applications with E85. I will use the term "mid-level" ethanol to denote ethanol contents of greater than 10% but less than 85%. Typically, however, mid-level will mean ethanol contents of greater than 10% to perhaps 15% or even 20% in gasoline.

Driven by a number of factors producers of ethanol have been proposing to increase the ethanol content of gasoline to greater than 10% for the last several years. For the last six years I have been very involved in various assessments of what would occur if this happened, particularly in non-road engines. I am examined in detail all prior work done in this country and abroad in this regard. I have evaluated work done in Australia, other countries and by the Dept. of Energy (DoE) and have critiqued the DoE work (Attachment II). I have also conducted additional technical analyses. These are provided in a technical paper in Attachment III to this testimony.

Unequivocally, the answer is that millions of products including most non-road engines and equipment will sustain a range of damage if the ethanol content of gasoline is increased to 15%. I believe that work by the US Dept. of Energy, also confirms this. Extensive documentation of likely adverse impacts, including impacts on safety, durability, loss-of performance, environmental impacts, etc. is documented in many reports and studies and is summarized in my paper in Attachment III.

In brief, the impacts include

A. Heat

Increased Ethanol in gasoline could result in increased engine heat, including consumer accessible components, such as the plastic engine cover, guards, etc. Higher engine heat may result in potential safety concerns, especially in smaller hand held lawn and garden products that are held in close proximity to the operator. A product operator could inadvertently come in contact with the hotter plastic engine housing or other surfaces because they are unaware of the added heat caused by the higher ethanol gasoline.

Current two-cycle engine oils do not mix well with alcohol, which may also increase engine heat and lead to premature engine failures.

Increased heat causes damage to gaskets and piston seals, which in turn, causes increased emissions of HC and NOx, as documented by the tests performed by DoE.

B. Fuel Leaks and Evaporative Emission Increases

The effects of higher ethanol levels on engine components are not fully known, but may result in earlier degradation of existing and legacy engine seals, gaskets, fuel lines, etc.; the deterioration of these components could lead to fuel leaks and increase the risk of fire if an ignition source is present.

E-15 also causes increased permeation and evaporative emissions.

C. Unintended/Early Clutch Engagement

Higher levels of Ethanol will also mean higher oxygen levels in fuel and result in higher engine speeds.

The higher engine speed may present unintended clutch engagement, which may result in potential safety concerns for bladed products, such as brush cutters, edgers, chain saws, hedge trimmers and pruners where the customer is expecting the blade to start moving at a different speed from prior product experience.

For example, a chain saw chain may now turn at idle speed when it did not with the lower ethanol content fuel, which may surprise the operator and cause an accident.

Ethanol damage to engines and products is permanent. The DoE's testing on outdoor power equipment concluded that 28 engines in four families showed increased heat, performance irregularities, failure and unintentional clutch engagement.

EPA's REGULATORY ACTIONS

Let me say at the outset that EPA is faced with difficult decisions in balancing competing objectives and we are sensitive to its predicament.

In response to the problems discussed above, the EPA, in granting Growth Energy's petition, has excluded from the waiver approval the entire universe of non-road engines and equipment, along with automobiles that are model year 2000 and prior. However, the practical effect of EPA's waiver to allow greater than 10% ethanol in gasoline will certainly affect non-road engines. Since this large non-road universe is actually is relatively small user of gasoline, by overall volume as compared to on-road automobiles, fuel suppliers and gas stations are unlikely, in general, to make available E10 or lower ethanol content gasoline in addition to E15.

EPA's answer to this dilemma is to rely on a label at the dispenser that fails to adequately warn consumers of the adverse impacts of greater than 10% ethanol on their engines and equipment. However, disappointingly, EPA's recent label rule proposes a mild, "ATTENTION" in an unobtrusive color label that is unlikely to be effective at this. EPA also declines to mandate the continued availability of E10 in order to support this universe of equipment—stating that market forces would continue to make this fuel available.

LIKELY FUTURE IMPACTS

Thus, the most likely scenario would be the introduction of greater than 10% ethanol fuel into this non-road universe that cannot and is not designed to handle it. Of course there will be substantial damage to millions of products and millions of consumers will be faced with with loss of durability and loss of functionality from equipment already paid for. But, more crucially, one should also expect more risk to consumers due to potential fuel leaks and fires (perhaps on a boat in open water or in an enclosed garage), equipment starting when not intended (such as a chainsaw), or burns sustained by an operator due to the increased exhaust gas temperatures associated with greater than 10% ethanol.

Avoidable financial and human loss/suffering aside, one of the more lasting unintended impacts of all of this will be to the perception of ethanol itself as a fuel or fuel component. I am not sure that this is what the backers of higher ethanol in gasoline intend. Yet, that would be the logical consequence of pushing EPA to introduce ethanol into gasoline at levels for which the user population is simply not ready.

SUGGESTIONS FOR PROPOSED NAS STUDY

I have reviewed the language of the proposed legislation that would require a study by the National Academy of Sciences to address this issue. While I generally agree with the scope of the proposed study, I have a couple of suggestions. First, I recommend that the focus of the study be on the implications and ramifications, including increased financial and non-financial risks from the use of greater than E10, particularly in the non-road fleet. Second, the NAS study scope should also include a critical examination of the issue of mis-fueling under the proposed EPA labeling scheme and investigate how mis-fueling can be minimized via options other than labeling.

I will be happy to answer any questions that Members of the Committee may have.

Preliminary Concerns on the Report Titled *"Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1—Updated,"* NREL/TP–540–43543 and ORNL/TM–2008/117, dated February 2009

Dr. Ron Sahu, Consultant to the Outdoor Power Equipment Institute (OPEI)

These comments focus exclusively on major adverse impacts observed during the tests performed on Small Non-Road Engines (SNRE), including lawn, garden and forestry products, like lawnmowers and trimmers.

I. THE TESTS DOCUMENT THE FOLLOWING MAJOR ADVERSE IMPACTS RESULTED FROM FUELS GREATER THAN 10% ETHANOL

A. Engine exhaust temperatures rose significantly. Significant rises in temperatures (exhaust, cylinder head, etc.) occurred on the order of 20 to 70 C from engines run on E0 compared to E20. For several categories, significant temperature rises resulted between E10 and E15. Additional heat generation has obvious implications on increased burn and fire hazards—considering the proximity of cut grass, wood chips and the operator to the engine's hot exhaust. However, the report does not delve into the implications of the additional heat and its ramifications on engine and equipment failure, personnel safety, increased fire hazards, or the inability to mitigate any of these hazards on millions of pieces of legacy equipment.

B. Risks to operators dramatically increased. The report recognizes that unintentional clutch engagement resulted on several tested products because of high idle speeds. Obviously significant risks are created when a chainsaw blade becomes engaged when the product should be idling. However, there is no discussion in the Report of this increased hazard. If anything, the mitigation proposed (i.e., adjustment of fuel air mixture enleanment) is feasible to adjust carburetors on millions of legacy equipment that are already in use.

C. Damage to Engines. Both of the tested "Residential Handheld Engines" (engines B–3 and B–7 as shown in Figure 3.9, pp. 3–18) suffered total and complete failures and would not start or operate after running on E–15 fuel for 25 or less hours, which is less than half of their useful life.

D. Operational Problems. Many of the engines tested on mid-level ethanol suffered from erratic equipment operation, "missing" and stalling of engines, and power-reduction.

II. MISCHARACTERIZATION OF RESULTS IN THE EXECUTIVE SUMMARY

The Executive Summary does not accurately summarize the scope, results as well as uncertainties associated with the testing. Since most of the policy-makers will focus only on the Executive Summary, this could result in misinformed policies based on misleading conclusions.

There appear to be numerous, material inconsistencies in the manner in which the results are reported in the main body of the report versus in the Executive Summary, including the following examples:

A. The Executive Summary merely notes three handheld trimmers experienced higher idle speeds and unintentional clutch engagement. (See Sec. E.5.2). The report recognizes that this same problem could also occur on chainsaws. (See Sec. 3.2). The implications of unintentional clutch engagement in chainsaws and hedgeclippers (which are both examples of should have been fully addressed in the Executive Summary.

B. With regards to materials compatibility, the Executive Summary incorrectly concludes that "... no obvious materials compatibility issues were noted." (see p. xix). In fact, the report itself recognizes that materials incompatibility (such as swelling of the elastomeric seat for the needle in the carburetor bowl) could be the cause of the engine stall for the Briggs and Stratton generator observed in the pilot study (see pp. 3–15). The report also states that: 1) "... various fuel-wetted materials in some small engines may not be compatible with all ethanol blends ..." (see p. 3–9); and 2) "... materials compatibility issues were not specifically characterized as part of the study ..." (see p. 3–12).

C. Engines in the study experienced "unstable governor operation," "missing" and "stalling" when operating on E20 fuel, indicating unacceptable performance. (See Section 3.2.2). However, the Executive Summary omitted any discussion of these substantial problems.

D. Discussing emissions, the Executive Summary simply notes that HC emissions "generally decreased" and that combined HC+NOx emissions "decreased in most instances." (See p. xix). However, the report notes that while HC emissions generally decreased, they also increased in some engines. The net change in HC+NOx emissions ranged from -36% to +41% as reported in Sec. 3.2.2. It is important to note that for new engines, the net change in HC+NOx was often greatest in going from E0 to E10 and smaller in the other transitions (i.e., from E0 to E15 or E0 to E20). (See Table 3.7). For example, the numerical average for all engines shows that the HC+NOx reduction was -16.6% from E0 to E10; -13.5% from E0 to E15 and only -9.5% from E0 to E20. Since small engines are already capable of E10 operation and

that fuel is HC+NOx from E10. (As a side note, what is actually measured as HC in the study is unclear since a FID was used for this purpose, uncorrected for any ethanol or aldehydes, as noted in the report).

III. DEFICIENCIES IN THE TESTING PLAN AND SCOPE

A. No emissions testing pertaining to evaporative emissions was conducted. Thus, all references to "emissions" means tail-pipe emissions from the engine. Evaporative emissions are now regulated by EPA for small engines and equipment and covered by the EPA "certification" program. Lack of evaporative emissions is a major omission.

B. The report does not contain any direct data on "materials compatibility" testing or results—i.e., involving the various fuels tested and the materials that may be exposed to these fuels and how they interact. Material compatibility is a significant concern with E15 and E20 fuels when used in small engines, leading not only to "operational issues" but also to durability, emissions, and safety impacts.

C. The report notes that the following fuels were used: E0, as well as splash-blended E10, E15, and E20. However, the report does not contain the actual ASTM specification of the blended fuels, including all relevant properties such as distillation cut point temperatures, etc. Table 2.2 of the report contains a few parameters of the blends. This is incomplete and a more complete fuel specification should be provided. The executive summary concludes that "... the different fuel characteristics of match-blended and splash-blended fuels were not expected to have a significant impact on temperature" or on durability. (See p. xviii). However, there is not any cited technical support for these statements. Similarly, there is no support for the observation that "... emission results ... are not expected to vary significantly. . .between blended and match-blended fuels." *Id.*

D. As the report notes, neither cold-start, nor warm-up testing was done, although these are two very common modes of operation for many categories of small engines. Additional performance tests that impact "operational issues" which should have been tested include: (i) acceleration; (ii) application performance; (iii) carburetor and breather icing; (iv) fuel consumption; (v) governor stability; (vi) load pick up; and (vii) vapor lock. Individual categories of small engines will likely have additional performance-related test requirements.

E. As the Executive Summary notes, the report presents "initial results ... focused on identifying emissions or operational issues and measurement of several key engine temperatures." (See p. xviii). It is not clear what is meant by "operational issues" or what quantitative surrogates and/or metrics were used to substitute for operational issues. It appears that erratic operation, high idle, stalling, etc. were used as evidence of operational issues. While these are undeniably evidence of operational issues, no testing appears to have been done on various actual equipment operational modes (as discussed later) so the full extent of operational issues has by no means been evaluated.

F. The report does not fully flesh out the issue and implications of irreversibility—i.e., once exposed to E15 and/or E20, performance is not restored simply by reverting to E0. In the case of the Poulan weedeater, it is noted that there were poor operations with E15 and E20 and that "normal operation could not be restored on E0." (See Section 3.2.2). This is significant. Actual users, when faced with operational problems with ethanol blended fuels, will, as common sense dictates, revert to E0. What they will find is that doing so will not "unring the bell" since the damage by the ethanol blends is not reversible simply by changing the fuel.

IV. UNREPRESENTATIVE AND LIMITED NUMBER OF TESTS CONDUCTED

A. The category of forestry, lawn and garden equipment includes a broad swath of equipment and engine types. Yet, the category has not been defined in the report so that the extent of test results presented can be judged in context. While noting that millions of products with small engines are sold each year (actually tens of millions), and that EPA certifies on the order of 900 engine emission families, the report does not cover the immense diversity of the category including: 1) the various engine and equipment types used, 2) the fuel delivery mechanisms, 3) the various sizes and functions of the equipment, 4) the constraints that the equipment operate under (such as close proximity to operators, as an example), and 5) many other characteristics. Engines in this product category utilize a wide variety of engine architecture including both single and twin cylinders, two cycle and four cycle combustion, ported and valve charge controlled, side valve and overhead valve orientations, with and without exhaust after-treatment, governed load and product load con-

trolled, etc. The report should clearly qualify its findings are based on a tiny fraction of the diverse population of affected products.

B. The types and numbers of engines and equipment tested are inadequate to be representative of even the limited types of small engines that were the subject of testing. While practical constraints such as time and money will always constrain the amount of testing that can be done, the basis for choosing the engine and equipment—namely those found in "... popular, high sales volume equipment." appears not to have been followed. For example, of the six pieces of equipment selected for the pilot study, four were generators. No chainsaws were tested, even though the OPEI had directly requested that they be included—because of their extreme operating conditions and sensitivity to mid-level ethanol. Also, it is explicable why only one residential hand-held engine would be tested, even though these are likely to be very sensitive to fuel changes. The report should provide the basis of selection rather than referencing unspecified EPA sources. One of the constraints also seems to have been the available laboratory equipment (i.e., lack of small engine dynamometers). This is clearly an inappropriate basis for constraining equipment selection, especially if the goal is to obtain data on the entire class of affected engines and products.

C. The report rightly notes the challenges associated with multi-cylinder engines—although characterizing these as being "more sensitive" is too vague. (See p. 3–11). It is unfortunate that while the study included one twin cylinder engine in the initial screening process, there were no twin cylinder engines included in the more in depth portions of the testing program. Particularly when the initial screening test clearly demonstrated significant influences of higher ethanol blends. A significant portion of the Class 2 (>225 cc) non-handheld engines produced each year are two cylinder engines. The omission of these engines in the expanded program is puzzling. The detailed test program should include engines and equipment that demonstrated any significant influence during the screening tests.

D. The limited number of tests conducted cannot provide assurances that the results presented have any statistical significance, where appropriate. In fact, no attempt is made to discuss results in terms of statistical significance. Nor are such issues discussed in support of the design of the test matrix itself. For example, no pair-wise tests were run or results reported even though those opportunities were available even with the limited equipment selection.

E. The manner in which the tests were run makes it difficult to separate the effects of engines, fuels, and aging. For example, the full-life tests do not allow the ability to distinguish between fuel-driven and engine-driven causes since only one engine was tested on each fuel. In the pilot study, the effects of the fuel and aging are similarly hard to separate. These types of issues could have been avoided with better test planning.

V. OTHER COMMENTS

A. The comments are preliminary because not all of the test data discussed in the report are included. Specifically, backup test data for all tests conducted by the Dept. of Energy (NREL and ORNL) and its contractors (TRC) still need to be provided.

B. The report notes that the test plan was developed with close consultation involving, among others, "... US automobile companies, engine companies, and other organizations ..." It would be helpful to have details of all the companies and individuals consulted in an Appendix to the report.

C. The report does not separately discuss the comments of the peer reviewer(s) and what changes were made to the draft report as a result. While the Acknowledgements note that the peer review panel was led by Joseph Colucci, the report does not contain a list of all peer reviewers used, what portions of the report were peer reviewed by whom, and the necessary vitae for the reviewers. This should be included.

TECHNICAL PAPER ON THE INTRODUCTION OF GREATER THAN E10-GASOLINE BLENDS

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1.0 Introduction

Recent debates driven by issues ranging from reducing dependence on foreign oil, reducing global climate change impacts, reducing the rapid escalation of gasoline prices at the pump, and even improving national security have resulted in the call to increase the proportion of renewable fuels available to users. In particular, there have been marked calls to rapidly increase the proportion of ethanol (ethyl alcohol) in gasoline. The current gasoline pool in the U.S. contains anywhere from 0% by volume (E0) to 10% by volume of ethanol (E10) depending on time of year and location. A mix of 85% ethanol in gasoline (E85) is also available as a motor fuel for vehicles that are capable of using the fuel. There are several efforts underway to statutorily increase the E10 proportion to greater than 10%. In particular, Minnesota has targeted 20% ethanol in gasoline as the goal for fuel for the conventional market, and legislators in other states have attempted to mandate 30% and 50% ethanol blends.

At first glance, increasing the ethanol content from 5–10% to higher levels in gasoline does not seem like a very radical idea. Assuming ethanol availability, proponents argue that it should be easy to implement and will help meet several policy goals. The argument goes as follows: all current engines and equipment fuel systems that run on gasoline already run successfully on E5–E10. Thus, why should there be any additional difficulty in increasing the ethanol content in gasoline? Further, proponents ask why there should be difficulties if others (particularly Brazil) have been able to make the switch to greater than E10. Surely all technical issues should have already been addressed. These lines of reasoning, however, are overly simplistic. They fail to properly consider the interaction of these proposed fuels with a large and extensive existing (or legacy) fleet of over 300 million pieces of equipment and vehicles that have to run successfully on the fuel they are given but are designed to run only on gasoline containing up to 10% ethanol. They also fail to consider the peculiar chemistry and physical properties of ethanol-gasoline mixtures and how these can dramatically affect the transportation, storage, combustion, and emissions of such fuel mixtures. These technical issues are not intuitive. This paper will discuss some of these key technical issues that need to be carefully considered before allowing greater than E10 in the conventional U.S. motor gasoline pool. Finally, it should also be noted that many engines and products are built for global distribution and fuel mix changes in the U.S. can have impacts on how such products have to be designed and distributed in the future.

2.0 Description and Diversity of Affected Equipment

A primary focus of this paper is the impact of greater than E10 fuels on the existing pool of equipment that will need to use this fuel. Broadly, this pool consists of on-road equipment—mainly automobiles and motorcycles—and off-road equipment—which ranges from the smallest hand-held 2-stroke chainsaw to large off-road machinery and from lawn-mowers to personal watercraft. Table A contains a list of the various types of off-road equipment that are designed for and run on conventional gasoline.

There is a vast amount of diversity in the existing gasoline-using vehicle and equipment population that, altogether, can be categorized based on the following:

-Use (e.g., lawn and garden; marine; snowmobiles, transportation, etc.)
-Engine Size (e.g., displacement ranging from less than 20 cc to 6000 cc)
-Expected Useful Life (50 hours or less to 10,000 hours)
-Engine Design
  -Air or water cooled
  -2-Stroke, 4-Stroke, or hybrid (2/4 Stroke)
  -Side-valve or overhead valve
  -Variable valve timing
  Intake air charging—superchargers, turbochargers, etc.
-Fuel Injection Technology
  -Carbureted—float-type, diaphragm type, single and multi-circuit
  -Fuel Injection—multi-port, direct, etc.
-Control Technologies

-Open loop
-Closed loop

-Fuel Systems
-Variety of tank and hose materials
-Various evaporative control strategies for permeation and tank venting
-Various design considerations such as for multi-positional use

-Emission Control Systems
-Engine modifications
-Three-way catalysts and oxidation catalysts (2-stroke engines)
-Exhaust gas sensors and diagnostic systems
-Feedback systems

Considering all of the above, from a cost standpoint, on-road and off-road equipment can range from a $50 hand held blower all the way to a $100,000+ automobile or a piece of construction equipment.

The existing population of automobiles in the U.S. is estimated at close to 200 million units. The existing population of off-road equipment is around an additional 100 million. Assuming an average resale price of $10,000 for an existing car/truck and an average cost of $500 for existing off-road equipment, the nominal asset value that is represented by existing equipment is over 2 trillion dollars. Should this equipment be damaged and need to be replaced, the replacement costs would be even greater. The average American family possesses, in addition to 2 cars/trucks, several pieces of off-road gasoline-powered products ranging from lawn and garden equipment to recreational equipment. It is not an exaggeration to note that almost every American household has significant on-road and off-road equipment assets.

3.0 Fuel and Equipment Form a Single System

Another point that should be made is that the on-road and off-road equipment are designed from the very outset with a particular fuel or fuel range in mind. The performance or driveability,[2] durability, and emissions can only be assessed when the combined fuel and equipment is considered to be a single, combined, system. Equipment is rarely designed (or can rarely be economically designed in these very competitive markets) to anticipate a wide range of fuel properties. Fuel specifications, therefore, are very important, both to the manufacturer of the equipment and to the user.

4.0 Ethanol and Ethanol-Gasoline Mixture Properties

Ethanol has been used in the U.S. as a gasoline fuel additive since the late 1970s when it was used as a fuel extender due to gasoline shortages after the oil embargo as well as an octane enhancer since it improved the anti-knock performance of gasoline. In the early 1990s, the federal government began to require 2% oxygen by mass in the gasoline used in certain parts of the country to reduce smog. In this decade, when many state governments prohibited the use of the predominant oxygenate, MTBE,[3] ethanol then became the oxygenate of choice. Several states also have required ethanol use in winter ("gasohol") as a way to reduce carbon monoxide emissions.

Some (but not all) of the changes in fuel properties due to the addition of ethanol to gasoline include:

-Change in octane number
-Change in fuel volatility (as measured through several properties, including vapor pressure, vapor-liquid ratio, and the temperature-distillation curve)
-Change in the energy density
-Change due to the oxygen content
-Effect on water solubility and phase separation

These property changes can affect performance, emissions, or both. Ethanol also may affect the fuel's compatibility with various materials, which means it can affect the product's durability.

4.1 Change in Octane Number

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[2] Based on years of research, good driveability is generally considered to include the following: quick starting, stall-free engine warm up, smooth idle, hesitation-free response to throttle, surge-free operation during cruise, and freedom from vapor lock. Driveability is rated at idle, during acceleration, and under cruise or normal operating conditions as the car/equipment engine is driven through a prescribed cycle.

[3] States started banning MTBE (methyl tertiary butyl ether) after leaking underground fuel storage tanks caused it to be found in groundwater.

In general, addition of ethanol up to a certain amount improves gasoline's octane number due to its excellent anti-knock properties. Engines specifically designed to use high octane fuels, such as high performance engines, may use higher compression ratios or increase charge air compression to increase power output.

4.2 Change in Fuel Volatility

A fuel's ability to vaporize is referred to as its volatility. It is represented by several measurements, including vapor pressure, vapor-liquid ratio and the amount vaporized at different temperatures (distillation). The vapor pressure of the fuel, which is very important from both an emissions and performance standpoint, may be the property most familiar to the public. Typically, refiners optimize and maintain vapor pressure in a given range for performance, business, and regulatory purposes. If the vapor pressure of the fuel is too low, that may cause problems in starting engines in cold temperatures; if it is too high, it may cause vapor lock at high temperatures. In either case, the driver or operator will experience performance problems.[4] High vapor pressure and the presence of ethanol also increases evaporative/diffusional emissions (and fuel loss) as well as higher permeation losses.[5]

The vapor pressure of ethanol is lower than that of gasoline. However, the addition of ethanol to gasoline, especially at lower concentrations, can actually increase the vapor pressure of the mixture to greater than that of gasoline. It depends on the amount of ethanol added and the composition of the base gasoline.[6] For blends using a base gasoline with a vapor pressure of 9 psi, the vapor pressure increase reaches a maximum around E5, and then slowly starts to come down with further increase in ethanol concentration.[7]

So, what is the effect of ethanol/gasoline blends on engine performance? Gasoline does not ignite as a liquid, only as a vapor. There must be sufficient fuel vapor present inside the combustion chamber to initiate and sustain combustion, i.e., to get the engine to start. This vaporization is governed by the fuel's overall volatility, measured by its distillation curve. Within a certain temperature range (that varies with each blend), ethanol decreases the temperature at which the fuel vaporizes, which, theoretically, should help combustion. However, ethanol blends also require more heat to vaporize than gasoline, which means that less vapor than predicted by the distillation curve is actually present inside the cylinder. For example, E10 requires over 15% more heat to vaporize than gasoline. Thus not only the distillation percentage versus temperature, but the heat input required to achieve the temperature are important to understand how fuel differences will interact with the engine design and the operating conditions. Current fuels are formulated to address this phenomenon. These fuel formulations allow the fuel blend to provide the desired amount of fuel vapor at the temperatures and air pressures typically found in engines to provide the expected starting and hot engine operation characteristics.

Other concerns about low temperature fuel characteristics of blends include a) increased viscosity of ethanol/gasoline blends which may impede fuel flow and b) phase separation in the vehicle fuel system due to reduced water solubility.

The primary fuel-related concern that occurs at elevated ambient temperatures is vapor lock. Vapor lock is a condition where the fuel in the engine's fuel delivery system vaporizes preventing the required volume of fuel to be delivered. Increasing the ethanol concentration beyond E10 is likely to increase the likelihood of vapor lock for open loop fuel control system engines typically used on older vehicles and most off-road engines. Even in the closed loop engine systems used in some off-road engines and in most late-model vehicles, there remains the likelihood of vapor lock.

4.3 Change Due to the Enleanment Effect of Ethanol

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[4] Issues associated with driveability and operational problems have been discussed for on-road vehicles and for off-road equipment in a series of reports in 2002–2004 by Orbital Engine Company for a biofuels assessment conducted in Australia. In particular, see (a) A Testing Based Assessment to Determine Impacts of a 10% and 20% Ethanol Gasoline Fuel Blend on Non-Automotive Engines, January 2003; (b) Marine Outboard Driveability Assessment to Determine Impacts of a 10% and 20% Ethanol Gasoline Fuel Blend on a Small Batch of Engines, February 2003 and (c) A Testing Based Assessment to Determine Impacts of a 20% Ethanol Gasoline Fuel Blend on the Australian Passenger Vehicle Fleet—2000hrs Material Compatibility Testing, May 2003.

[5] Permeation is a process that is not yet fully understood; other factors besides vapor pressure also likely play a role in permeation rates.

[6] Gasoline is a mixture of several different molecules, and its composition can vary widely.

[7] American Petroleum Institute (API), Alcohol and Ethers: A Technical Assessment of Their Application as Fuels and Fuel Components. API Publication 4261, Third Edition. June 2001.

Gasoline is a mixture of many hydrocarbon compounds that consist mainly of hydrogen and carbon.[8] Ethanol also contains hydrogen and carbon—but, in addition, it also contains oxygen. The exact air-to-fuel ratio needed for complete combustion of the fuel (to carbon dioxide and water vapor) is called the "stoichiometric air-to-fuel ratio." This ratio is about 14.7 to 1.0 (on weight basis) for gasoline. For ethanol/gasoline blends less air is required for complete combustion because oxygen is contained in the ethanol and because some of the hydrocarbons have been displaced. For example, for E10 the stoichiometric air-to-fuel ratio is 14.0 to 14.1 pounds of air per pound of fuel. To deliver the required power for any given operating condition engines consume enough air and fuel to generate the energy required, to the limit of the engine's capabilities. Because fuel delivery systems are designed to deliver the prescribed amount of fuel on a volume control basis the fuel volume delivered is related to the volume of air introduced. The engine design anticipates that the fuel utilized will match the air-to-fuel ratio characteristics utilized in the engine design and calibration. Because ethanol blended fuels require more fuel for the same amount of air to achieve stoichiometric conditions, the fuel system must adapt by introducing more fuel or the desired mixture is not achieved. The effect of this type of fuel change on an engine is called "enleanment."

The effect of enleanment depends on engine design and how fuel is metered into the engine. Since the early 1980s, most automobile engines in the U.S. have used some form of "closed loop" fuel system that continuously monitors and adjusts the amount of fuel delivered to the engine to maintain the stoichiometric air-to-fuel ratio. These vehicles have adjustment ranges that can accommodate oxygenated fuels and, when operating in the "closed loop" mode, may not experience any adverse effects from oxygenated fuels once they have reached operating temperature. Even these vehicles, however, during cold start and at full throttle, can operate in an "open loop" mode that provides a rich fuel mixture that is necessary for these conditions and to allow the control system to achieve operating temperatures. In the rich mixture, "open loop" mode, vehicles can experience enleanment effects from the oxygenated fuel. While most on-road engines have closed-loop systems, most off-road engines do not. Thus, they have no way to compensate for this enleanment condition. Lean operation can have several negative attributes including higher combustion temperatures. Even with closed-loop systems, if the fuel contains an amount of ethanol that is outside the system design, the engine similarly may receive too much oxygen and experience performance problems. Additional Orbital test reports[9] discuss the performance issues associated with on-road vehicles and off-road equipment using E20 fuels.

4.4 Effect on Water Solubility and Phase Separation

Separation of a single phase gasoline into a "gasoline phase" and a "water phase" can occur when too much water is introduced into the fuel tank. Water contamination is most commonly caused by improper fuel storage practices at the fuel distribution or retail level, or the accidental introduction of water during vehicle refueling. Water has a higher density than gasoline, so if water separates, it will form a layer below the gasoline. Because most engines obtain their fuel from, or near, the bottom of the fuel tank, engines will not run if the fuel pick up is in the water phase layer.

Typically, gasoline can absorb only very small amounts of water before phase separation occurs. Ethanol/gasoline blends, due to ethanol's greater affinity with water, can absorb significantly more water without phase separation occurring than gasoline. Ethanol blends can actually dry out tanks by absorbing the water and allowing it to be drawn harmlessly into the engine with the gasoline. If, however, too much water is introduced into an ethanol blend, the water and most of the ethanol will separate from the gasoline and the remaining ethanol. The amount of water that can be absorbed by ethanol/gasoline blends, without phase separation, varies from 0.3 to 0.5 volume percent, depending on temperature, aromatics, and ethanol content. If phase separation were to occur, the ethanol/water mixture would be drawn into the engine and the engine would most likely stop.

In some situations, ethanol/gasoline blends might absorb water vapor from the atmosphere, leading to phase separation. Such problems are of greater concern for en-

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[8] Sulfur, nitrogen, and trace elements also may be present.

[9] Orbital Engine Company Reports: (a) A Literature Review Based Assessment on the Impacts of a 20% Ethanol Gasoline Fuel Blend on the Australian Vehicle Fleet, November 2002; (b) Market Barriers to the Uptake of Biofuels Study Testing Gasoline Containing 20% Ethanol (E20) Phase 2B Final Report, 2004.

gines with open-vented fuel tanks that are operated in humid environments, such as marine engines.

Additionally, more complex phenomena such as lubricating oil/fuel separation (in 2-stroke engines) and temperature-induced phase separation of various fuel components have also been noted.

4.5 Effect on Material Compatibility

A variety of components in engine/equipment systems can come into contact with the fuel. These include

-Fuel Lines
-Fuel Tanks
-Fuel Pumps
-Fuel Injectors
-Fuel Rails
-Carburetors (and internal components)
-Pressure Regulators
-Valves
-0-Rings
-Gaskets

Materials used in these components should be compatible with the full range of expected fuel composition. Table B shows the types of metals, rubbers, and plastics that are used in existing engines and fuel system components currently designed to run on E10 fuel blends. This is not an exhaustive list and is meant as an illustration of the diversity of materials used presently. The compatibility of all of these materials with greater than E10 fuel blends is currently unknown; little testing has been done because higher level blends are illegal for use in conventional products and vehicles, so there has been no reason to test. However, some test data is available from testing on E20 fuels by others.[10] Based on these studies, it is clear that several rubbers and elastomers can swell and deteriorate more rapidly in the presence of ethanol. Other materials, such as fluoroelastomers may be able to handle a range of ethanol blends. Ethanol also corrodes certain metals. Corrosion occurs through different mechanisms including acidic attack, galvanic activity, and chemical interaction. The first is caused by water in the fuel. Ethanol attracts and dissolves water, creating a slightly acidic solution. Unlike gasoline, ethanol alone or combined with water conducts electricity; this conductivity creates a galvanic cell that causes exposed metals to corrode. Another mechanism is direct chemical interaction with ethanol molecules on certain metals.

Clearly, deterioration of materials would result in loss of function of critical engine components, resulting in fuel leaks, fires from fuel leaks, and equipment failure. This has obvious safety implications.

As noted earlier, permeation of fuel through elastomers can result in deterioration of these materials. In recent testing, all of the tested ethanol blends showed higher permeation rates through elastomers than conventional gasoline.[11]

5.0 Effect on Emissions

Various studies have been conducted on assessing the effect of E5–E10 on engine exhaust emissions of NOx, hydrocarbons, CO, and other air toxics. Based on these, it is generally true that emissions of CO are reduced in the presence of ethanol due to the presence of the oxygen atom in the fuel. Exhaust emissions of hydrocarbons may increase or decrease, depending on such factors as engine or product design and the overall fuel properties. However, NOx emissions from conventional products and vehicles generally increase since enleanment creates conditions which increase NOx.[12] The degree of increase of NOx, however, is a complex function of engine design and other operating conditions. For sophisticated closed-loop operation, NOx emission increases can be small, but for less sophisticated open-loop engines, NOx emission increases can be dramatic. While many of the toxics show expected de-

[10] A Testing Based Assessment to Determine Impacts of a 20% Ethanol Gasoline Fuel Blend on the Australian Passenger Vehicle Fleet—2000hrs Material Compatibility Testing, May 2003 and A Testing Based Assessment to Determine Impacts of a 10% and 20% Ethanol Gasoline Fuel Blend on Non-Automotive Engines -2000hrs Material Compatibility Testing, May 2003.

[11] (a) See EPA–420–D-06–004, Draft Regulatory Impact Analysis: Control of Hazardous Air Pollutants from Mobile Sources, Chapter 7, February 2006. (b) See also, Fuel Permeation from Automotive Systems: E0, E6, E10, E20, and E85, Final Report, CRC Project No. E–65–3, December 2006.

[12] Enleanment creates an increase in oxygen and nitrogen in the combustion zone.

creases in the presence of ethanol, some toxics, such as aldehydes, can show increases. Besides the potential toxic effects of aldehydes in exhaust gases, the aldehydes act as an ozone precursor and increase the smog-forming potential. Again, the presence of post-combustion emissions controls such as three-way catalysts (in automobiles) can mitigate aldehyde emissions increases to a certain extent. Although there are some off-road equipment and vehicles utilizing catalytic converters today, the majority of off-road engines are not equipped with catalysts.

The emissions effects of increased ethanol in gasoline are generally not linear with the amount of oxygen in the fuel. Hence, the effects of increasing the ethanol content beyond E10 on exhaust and evaporative emissions on current engines are not fully known.

Table C presents an overview of these effects and how they can influence emissions, performance, and durability, mainly for automobiles; but, in some instances, the effect of increased ethanol on less sophisticated off-road engines is also noted.

6.0 Ethanol-Compatible Design

Scientists and engineers have learned how to make automobile and off-road engines and fuel systems compatible with ethanol-gasoline blends. For current off-road engines, the maximum amount of ethanol than can be tolerated in current designs is E10. There is very little ability in such engines to adapt to higher ethanol levels given their open-loop, factory tuned, carbureted designs. For certain automobiles, however, higher levels including E85 can be used. As noted earlier, experiences from other countries, such as Brazil, in this regard can be relevant. It is instructive to review the types of changes that have been made in certain automobiles to handle greater than E10 fuels. Table D shows the types of changes that have been made in Brazilian vehicles in order to accommodate higher ethanol blends. The reader can then understand the complexity of (a) implementing such changes across the broad spectrum of all on-road and off-road engines; and (b) the near impossibility of implementing such changes in the existing on-road and off-road equipment fleet.

For automobiles designed to handle greater than E10, the changes involve the use of innovative and ethanol-compatible technologies, material changes, and adjustments in calibration. Initially, a vehicle intended for higher ethanol use was designed specifically for a particular ethanol level, such as E85. Today, new technology has enabled the introduction of "flexible-fueled vehicles" (FFVs), which can burn fuel with any amount of ethanol up to E85. In all cases, one cannot adapt or retrofit existing products because too many parts and design steps are involved and the product may have size constraints. Necessary modifications must occur during design and production to ensure compliance with strict emission standards and to meet consumer expectations for safety, durability, performance, and cost.

6.1 E0–E10

The amount and type of modifications needed increase as the ethanol concentration in the gasoline fuel increases. At levels below about 5–6% ethanol by volume, product changes generally are not needed because the ethanol concentration is too low to cause significant impacts. Fuel blends with about 5–10% ethanol by volume, however, begin to require product important changes to maintain performance, durability, and/or emissions capabilities. For example, manufacturers can increase the corrosion resistance of some parts, such as carburetors and fuel pumps, and recalibrate the engine and emission control systems, among other possible changes.

E10 adaptations also include changing the overall fuel formula. As with any fuel, proper blending and formulation are required for best performance, durability, and emissions. ASTM International has developed voluntary industry standards for gasoline and E10 to help marketers produce fuel with acceptable formulations.

6.2 E10–E85

It should be noted at the outset that ASTM has a standard for E85 which covers formulations ranging from E70 to E85.[13] However, there are no standards for mid-level blends between E10-E70. Without standards, these formulations are being made on an ad-hoc basis by users, as needed typically by splash blending denatured ethanol with some type of base gasoline. Therefore, there is no comparability between properties of these mid-level blends made by various users.

[13] ASTM D5798–99, Standard Specification for Fuel Ethanol for Automotive Spark-Ignition Engines.

To ensure materials compatibility at higher ethanol levels for use with flexible fuel vehicles (FFVs) manufacturers use corrosion resistant materials in any part that may contact fuel. For example, Brazilian auto manufacturers, who have considerable experience producing ethanol-compatible vehicles, recommend using electronic fuel injectors made with stainless steel, larger holes, and modified designs to improve fuel spray. Similarly, manufacturers of carbureted engines—for example, almost all small engine products such as chain saws and lawn mowers, as well as older and antique vehicles—recommend, among other steps, coating or anodizing aluminum carburetors or substituting a different metal not susceptible to attack.

Boats have similar compatibility concerns. Many, for example, use aluminum fuel tanks that are susceptible to corrosion. While sacrificial zinc anodes often are added later to the external parts of these tanks, they are not feasible for the tank's interior.[14] Older yachts with fiberglass tanks have a different problem. Ethanol can chemically attack some of the resins used to make these tanks causing them to dissolve. In doing so, the ethanol causes leaks, heavy black deposits on marine engine intake valves, and deformation of push rods, pistons, and valves.[15]

Conventional vehicles and products do not have these material adaptations for higher level ethanol use. One device particularly difficult to address after-the-fact is the fuel tank level sensor. These sensors, which are placed inside the fuel tank, directly expose wiring to the fuel. Depending on how much ethanol these devices contact and for how long, galvanic corrosion would be expected to dissolve the wires and eventually cause device failure.

Corrosion inhibitors have been developed to try to delay or prevent corrosion of steel components in the ethanol distribution system, but these additives cannot be relied on to protect engines and vehicles. Furthermore, a soon to be released report by the American Petroleum Institute (API) implies corrosion inhibitors may increase stress corrosion in steel.

Manufacturers make additional design changes to address emissions and performance needs.[16] In this context, it is important to remember that U.S. emission standards are more stringent than those in Brazil. For U.S. vehicles, manufacturers select oxygen sensors and onboard diagnostic (OBD) systems specifically to cover the expected range of oxygen in the exhaust gas. If the fuel ethanol pushes the exhaust oxygen content outside the range of the oxygen sensor, the vehicle's OBD system won't work properly and may erroneously illuminate or fail to illuminate the dashboard warning light. In addition, manufacturers must calibrate vehicle and product systems to the expected fuel to ensure the proper air-fuel ratio for both emissions and performance purposes. In the U.S., off-road engines are also regulated for emissions regardless of their size or equipment that they power. Generally, the off-road engines do not utilize oxygen sensors and computer controls to adjust fuel delivery by a closed loop system. In many products, emission compliance has dictated air-to-fuel ratio controls that are a delicate balance between being too rich and, therefore, out of compliance, or too lean, resulting in performance or durability problems.

The long term durability of emission control systems is a critical issue, with current U.S. federal and California emission standards requiring vehicles to comply for up to 150,000 miles and off-road engines to comply for full useful life periods. If the control system of the vehicle was not designed to accommodate the leaning effect of ethanol, the vehicle's catalyst protection routine will be disabled. This will lead to the type of catalyst damage seen in an Australian study using vehicles that were also sold in the U.S.[17] For off-highway engines, or older vehicles without closed loop systems, the enleanment influence can result in higher exhaust gas temperatures. This can cause thermal degradation of the catalyst over time, either through sintering of the precious metal wash-coat or damage to the substrate and can also degrade critical engine components such as pistons and exhaust valves.

As noted earlier, an important emissions concern that remains poorly understood is ethanol's ability to permeate through rubber, plastic, and other materials used widely in the fuel tank, fuel system hoses, seals, and other parts of the fuel han-

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[14] NMMA Ethanol Position Paper, no date, available at www.nmma.org/government/environmental/?catid=573.

[15] Ibid.

[16] "Fuel Specifications in Latin America: Is Harmonization a Reality?" Henry Joseph Jr., ANFAVEA (Brazilian Vehicle Manufacturers Association), presented at the Hart World Fuels Conference, Rio de Janeiro, 21–23 June 2004.

[17] See references to Orbital Engine Company reports referenced earlier.

dling system. Recent studies have shown these emissions can be quite significant.[18] Automobile vehicle manufacturers (but not off-road engine manufacturers) are now using fewer permeable components in newer vehicles, so the emissions increase is more significant for older vehicles and off-highway products. Regulators expect permeation emissions will decrease over time as the on-highway fleet turns over to the newer products, but existing data are based on the use of E0–E10. Permeation rates for higher ethanol blends are largely unknown.

7.0 Conclusions

There are significant known and unknown technical issues associated with changing the U.S. conventional motor gasoline pool to accommodate higher than E10 blends. While some of these may be surmountable with additional research and the resultant use of new materials and engine/equipment designs, these can only be implemented in new equipment and with proper lead time. Important data gaps aside, with present knowledge, it is likely that there will be adverse, large-scale impacts if higher than E10 is required as motor gasoline for the existing fleet of on-road and off-road equipment, particularly the latter. Minimizing these likely adverse impacts on existing equipment and vehicles would require significant and expensive adaptation and mitigation measures.

[18] See, e.g.:, the CRC E–65–3 Project Report referenced earlier as well as the EPA document referenced earlier which also discusses testing conducted by the California Air Resources Board.

Table A

Types of Off-Road Equipment

A. Broad Categories

- Lawn and Garden
  - Hand-Held (chainsaws, trimmers, blowers, edgers, etc.)
  - Ground-Supported (lawn mowers, rider mowers, etc.)
- Industrial Equipment (generators, forklifts, etc.)
- Snow (snowmobiles, etc.)
- Marine (outboard/PWC, inboard, stern-drive)
- Off-Road Motorcycles
- All Terrain Vehicles

B. Detailed List

2-Wheel Tractors	Other Agricultural Equipment
Aerial Lifts	Other Construction Equipment
Agricultural Mowers	Other General Industrial Equipment
Agricultural Tractors	Other Lawn & Garden Equipment
Air Compressors	Other Material Handling Equipment
Air Conditioners	Paving Equipment
Air Start Units	Personal Water Craft
All-Terrain Utility Vehicles	Plate Compactors
Asphalt Pavers	Pressure Washers
Baggage Tugs	Pumps
Balers	Rear Engine Riding Mowers
Belt Loaders	Rollers
Bobtails	Rough Terrain Forklifts
Bore/Drill Rigs	Rubber Tired Loaders
Cargo Loaders	Sailboat Auxiliary Inboard Engines
Cement and Mortar Mixers	Sailboat Auxiliary Outboard Engines
Chainsaws	Shredders
Chippers/Stump Grinders	Signal Boards
Combines	Skid Steer Loaders
Commercial Turf Equipment	Snowblowers
Concrete/Industrial Saws	Snowmobiles
Cranes	Specialty Vehicles
Crushing/Processing Equipment	Sprayers
Deicers	Surfacing Equipment
Dumpers/Tenders	Swathers
Forklifts	Sweepers/Scrubbers
Front Mowers	Tampers/Rammers
Fuel Trucks	Tillers
Generator Sets	Tractors/Loaders/Backhoes
Golfcarts	Transport Refrigeration Units
Ground Power Units	Trenchers
Hydro Power Units	Trimmers/Edgers/Brush Cutters
Lav Carts	Vessels w/Inboard Engines
Lav Trucks	Vessels w/Inboard Jet Engines
Lawn & Garden Tractors	Vessels w/Inboard/Outboard Engines
Lawn Mowers	Vessels w/Outboard Engines
Leaf Blowers/Vacuums	Water Trucks
Minibikes	Welders
Motorcycles	Wood Splitters

Table B

Diversity of Materials Used in Engine and Fuel Systems

A. Metals

Aluminum (various grades)
Brass
Carbon Steel
Cast Iron
Copper
Magnesium (and alloys)
Zinc (and alloys)
Lead
Tin
Terne Plate
Solder (tin/lead)
Other metals and alloys

B. Rubbers

Buna N
Silicon Rubber (VMQ)
HNBR (Hydrogenated Nitrile Butadiene Rubber)
Others

C. Plastics/Polymers/Monomers/Elastomers

Hydrin (epichlorohydrin)
H-NBR (copolymer from butadiene and acrylonitrile)
Low Temp Viton (FKM) grades such as GFLT
Nylons (various grades)
Polyester urethane foam
NBR with 16% PVC and 32% ACN content
Ozo-Paracril (blend of PVC and nitrile rubbers)
CSM - Chlorosulfonated polyethylene, such as Hypalon
FVMQ - Fluorosilicone
HDPE – High Density Polyethylene
PS - Polysulfone
PC - Polycarbonate
ABS - Acrylonitrile Butadiene Styrene
EVOH -Ethylene Vinyl Alcohol
PPA - Polyphtalamide
PBT - Polybutylene Terephthalate
PE - Polyethylene – High Density Polyethylene (HDPE),
PE - LDPE Low Density Polyethylene (LDPE)
PET - Polyethylene Terephthalate (Mylar)
PP - Polypropylene
PPS - Polyphenylene Sulfide
PUR - Polyurethane
PVC - Polyvinyl Chloride
PEI - Polyetherimide (GE Ultem)
POM - Acetel Copolymer
HTN - DuPont™ Zytel® HTN
PTFE - Polyteraflouroethylene (Teflon)
POM - Polyoxymethylene (acetal/Delrin)
Fluorosilicones
Others

Table C

Properties of Ethanol And Associated Implications

Property	*Implication*
Hydrogen Bonding/Vapor Pressure	This makes pure ethanol have a very low vapor pressure compared to gasoline. But it also means the vapor pressure of a mixture can be higher than the gasoline alone. Where the peak vapor pressure occurs depends on the base gasoline vapor pressure and ethanol concentration. With a 9 RVP base gasoline, the peak occurs at around 6-7% by volume.[19] Vapor pressure directly affects the evaporation rate and potential hydrocarbon emissions.
Hydrogen Bonding/Water Attraction	Easy hydrogen bonding makes ethanol attract water. The presence of water, in turn, increases the risk that certain metals will corrode. This becomes a problem when fuel remains in storage (including vehicle fuel tanks) and handling systems for a long time.
Oxygen Atom	Ethanol's oxygen atom lowers its energy content, which reduces fuel economy. A blend's final energy content and the impact on fuel economy depends on the amount of ethanol and gasoline density. Most blends up to 10% ethanol by volume do not affect fuel economy to a significant extent (about 1-3%).
Oxygen Atom	Ethanol mixed with gasoline makes the air-to-fuel ratio leaner than with gasoline alone. Controlling the air-to-fuel ratio is critical to the combustion process and engine performance. Performance problems include hesitation, stumbling, vapor lock, and other impacts on driveability. Pre-ignition also can occur, causing engine knock and potential damage. Ambient temperature and pressure are important factors.
Oxygen Atom	Manufacturers calibrate the oxygen sensors (used in modern vehicle technologies but not in off-road equipment, in general) to recognize specific levels of oxygen in the exhaust stream. If a mixture is outside the calibration range, the sensor will send inaccurate signals to the air-to-fuel feedback and on-board diagnostic systems. This could cause improper air-to-fuel ratios as well as an increased risk of causing one of the dashboard's warning lights (MIL) to illuminate.
Higher Combustion Temperature	This increases the formation of NOx, an ozone precursor, in the exhaust gas. Modern three-way catalysts in vehicles reduce NOx by more than 99%, except before the catalyst fully warms up (i.e., during cold-start engine operation). Excessive combustion temperatures also can cause engine damage.
Higher Latent Heat of Vaporization	This can delay catalyst "light-off," which is period of time before the catalyst warms up and can reduce exhaust emissions of HC, CO, and NOx.
Higher Electrical Conductivity	This property increases galvanic corrosion of metals.
Permeability	Ethanol readily permeates at significant rates through elastomers, plastics, and other materials used widely for hoses, o-rings, and other fuel system parts. Depending on temperature and the materials used in the fuel system, this can significantly increase hydrocarbon emissions.
Solvency	Under certain conditions, the presence of ethanol can cause certain detergency additives to precipitate out of solution, leaving the engine unprotected from gummy deposits. Deposits can increase emissions, lower fuel economy, and increase drivcability problems.
Polarity or Oxygen Atom	Ethanol lowers fuel lubricity by binding to metal surfaces and displacing motor oil. This effect increases cylinder bore wear.
Solvency	Ethanol is an effective solvent that mixes readily with both polar and non-polar chemicals. This property allows ethanol to dissolve some adhesives used to make paint adhere to vehicle bodies. Ethanol also dissolves certain resins and causes them to leach out of the fiberglass fuel tanks used in some boats. Not only does this cause the tank to deteriorate, it also creates a sludge that coats the engine and can cause stalling and other performance problems.[20]

[19] See API Publication 4261, June 2001

[20] See "Important News for Boat Owners," at www.ethanolrfa.org.

Table D

Adaptation of Brazilian Vehicles[21] for Use with E22 or E85+[22]

System	Part Change
Air-Fuel Feed	Electronic fuel injectors: must use stainless steel and modify the design to improve fuel "spray" and throughput. Manufacturers calibrate the system to the fuel, to ensure the proper air-to-fuel ratio and an appropriate Lambda sensor working range.
	Carburetors: must treat or otherwise protect aluminum or zinc alloy surfaces.
Fuel Handling System	Fuel pumps: must protect internal surfaces and seal connectors; a different metal may be required.
	Fuel pressure regulators: must protect internal surfaces; internal diaphragm may need to be up-graded.
	Fuel filter: must protect internal surfaces and use an appropriate adhesive for the filter element.
	Fuel tank: if metallic, must protect (coat) the internal surface. If plastic, may need to line the interior to reduce permeation.
	Fuel lines and rails: may need to coat steel parts with nickel to prevent corrosion or replace with stainless steel.
	Fuel line quick connects: must replace plain steel with stainless steel.
	Hoses and seals: "o-ring" seals and hoses require resistant materials.
Emission Controls	Vapor control canister: may need to increase the size of the canister and recalibrate it for the expected purge air flow rate.
	Catalyst: may need to adjust the kind and amount of catalyst and wash coating.
Powertrain	Ignition System: must recalibrate ignition advance control.
	Engine: should use a higher compression ratio for proper operation; new camshaft profile and phase; and new materials for the intake and exhaust valves and valve seats.
	Intake manifold: must be able to deliver air at a higher temperature; requires a new profile and must have a smoother surface to increase air flow.
	Exhaust pipe: must protect (coat) the internal surfaces and ensure design can handle a higher amount of vapor.
Other	Fuel filler door paint: must change paint formula used on plastic fuel filler door to avoid loss of paint adhesion.
	Motor oil: may require reformulation and/or a new additive package.
	All parts that might be exposed to the fuel: avoid polyamide 6.6 (nylon), aluminum, and various zinc alloys. If these materials are used, their surfaces must be treated or otherwise protected.
	Vehicle suspension: may need to modify to accommodate a higher vehicle weight
	Cold start system (for E85or above): may require an auxiliary start system with its own temperature sensor, gasoline reservoir, extra fuel injector, and fuel pump; also, the vehicle battery must have a higher capacity.

[21] Brazil's vehicle emission standards are less stringent than those in the U.S., so U.S. vehicles may require additional effort and calibration to meet emission and durability standards.

[22] "Fuel Specifications in Latin America: Is Harmonization a Reality?" Henry Joseph Jr., ANFAVEA (Brazilian Vehicle Manufacturers Association), presented at the Hart World Fuels Conference, Rio de Janeiro, 21-23 June 2004.

BIOGRAPHY FOR DR. RON SAHU, TECHNICAL CONSULTANT, OUTDOOR POWER EQUIPMENT INSTITUTE

EXPERIENCE SUMMARY

Dr. Sahu has over twenty one years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment; soils and groundwater remediation; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multipathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over nineteen years of project management experience and has successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public. Notably, he has successfully managed a complex soils and groundwater remediation project with a value of over $140 million involving soils characterization, development and implementation of the remediation strategy, regulatory and public interactions and other challenges.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past seventeen years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the US Dept. of Justice, California DTSC, various municipalities, etc.). Dr. Sahu has performed projects in over 44 states, numerous local jurisdictions and internationally.

Dr. Sahu's experience includes various projects in relation to industrial waste water as well as storm water pollution compliance include obtaining appropriate permits (such as point source NPDES permits) as well development of plans, assessment of remediation technologies, development of monitoring reports, and regulatory interactions.

In addition to consulting, Dr. Sahu has taught and continues to teach numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) for the past seventeen years. In this time period he has also taught at Caltech, his alma mater and at USC (air pollution) and Cal State Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies.

EXPERIENCE RECORD

2000–present Independent Consultant. Providing a variety of private sector (industrial companies, land development companies, law firms, etc.) public sector (such as the US Department of Justice) and public interest group clients with project management, air quality consulting, waste remediation and management consulting, as well as regulatory and engineering support consulting services.

1995–2000 Parsons ES, Associate, Senior Project Manager and Department Manager for Air Quality/Geosciences/Hazardous Waste Groups, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.

Parsons ES, Manager for Air Source Testing Services. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992–1995 Engineering-Science, Inc. Principal Engineer and Senior Project Manager in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria

and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.

1990–1992 Engineering-Science, Inc. Principal Engineer and Project Manager in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.

1989–1990 Kinetics Technology International, Corp. Development Engineer. Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988–1989 Heat Transfer Research, Inc. Research Engineer. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984–1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, Caltech, Pasadena, CA.

1978–1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India.

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program,"—taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983–1989.

"Heat Transfer,"—taught this course in the Fall and Winter terms of 1994–1995 in the Division of Engineering and Applied Science.

"Thermodynamics and Heat Transfer," Fall and Winter Terms of 1996–1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992–93, Summer 1993–1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993–94, Winter 1993–94, Fall 1994–95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992–2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993–94.

"Advanced Hazard Analysis—A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993–1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution—Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992-present.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-present.

Air and Waste Management Association, West Coast Section, 1989-present.

PROFESSIONAL CERTIFICATIONS

EIT, California (# XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM–1699). Expiration 10/07/2011.

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"The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants," with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics—Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

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"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9–10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers—Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19–24, 1994.

Chairman HARRIS. Thank you very much, Dr. Sahu. And I will recognize myself for five minutes for questions. I want to again thank you very much, the whole panel, for your patience in letting us get a little late start because of the voting.

Let me just ask a question. Mr. Greco, did you mention valve and valve seats in your testimony and the possible affect on that?

Mr. GRECO. That is correct. That is one of the criteria we are looking at when we see engine durability. We have five different——

Chairman HARRIS. So we don't really know whether E15 would adversely affect the wear of valve and valve seats? And there is a specific reason I am asking. I mean, I have replaced valve and valve seats. I mean, if your valve seat fails prematurely, you lack compression, you will get whatever you are putting in that cylinder into the ambient air. I mean, it is not an emission control system specifically defined as such in a car manufacturer's manual, but it certainly functions as that because it seals off the combustion chamber from the ambient environment. Is that correct?

Mr. GRECO. That is correct, yes. The engine now has to handle that increased leakage as a result, potentially of ethanol.

Chairman HARRIS. Right.

Mr. GRECO. And we have seen some failures. Again, it is preliminary information, but that does seem to be one of the impacts that we see on some engines.

Chairman HARRIS. So if the EPA only studied, or the DOE in their study didn't take into account premature valve wear, they could come up with a conclusion, well, it doesn't affect any of the emission systems but it in fact could have an adverse effect on emissions from that car.

Mr. GRECO. That is correct.

Chairman HARRIS. That is what I thought.

Mr. GRECO. You would have to take a very narrow definition.

Chairman HARRIS. Okay. Ms. Oge, let me ask you a question. Did the EPA take into consideration the effect on emissions take into account that in fact, from what Vice-Chairman Sensenbrenner's letters from the auto companies would indicate, that the use of E15 in a car might invalidate the warranty on emission systems in the car?

Ms. OGE. Sir, what I want to let you know is that—can I answer something?

Chairman HARRIS. No, I only have five minutes.

Ms. OGE. Okay.

Chairman HARRIS. Okay, you have got to stay on my question.

Ms. OGE. Yes, we did, and that is——

Chairman HARRIS. You did?

Ms. OGE. Yes, we did.

Chairman HARRIS. So is it possible that use of E15 will invalidate the warranty on emissions control systems?

Ms. OGE. No, it is not. As long as E15 is used for 2001 and later in your vehicles, we strongly believe, and the record was in front of the Administrator that assigned the waivers shows, that 2001 and later vehicles will not be undermined.

Chairman HARRIS. You misunderstand my question. If I buy a car and its vehicle emissions system for some reason doesn't work right in four years, because they have to be warranted for five years is my understanding.

Ms. OGE. Yes.

Chairman HARRIS. So at four years, it stops working, I take it to the dealer and they say, oops. You have used E15. We are not going to repair this under warranty. If I live in a place where they don't test my vehicle emissions or they don't test me, I just go out and say, well, if you are not paying for it, I will just drive my car around with the emissions system not working. I mean, invalidating a warranty has an effect on emissions because these systems may not get repaired under warranty. If they don't get repaired under warranty, it may not get repaired at all.

Ms. OGE. So the warranty——

Chairman HARRIS. Did the EPA take that possibility that the warranties may be invalidated?

Ms. OGE. Again, the decision that we made, if the consumer uses E15 for 2001 and later vehicles, that warranty will not be impacted. So for your example——

Chairman HARRIS. Ms. Oge, how can it not be impacted when the——

Ms. OGE. Let me answer. Let me answer.

Chairman HARRIS. Well, again, I only have two minutes. You can't filibuster me on this. When we have letters from companies saying, specifically from Honda saying our manual says if you use

E10 and below, you are warranted. If you use E15, it will compromise the vehicle's warranty.

Ms. OGE. Sir, we talked to Honda. We talked to all the companies. We have seen the letters that came back from the car companies. There are not any facts or any hard data to demonstrate—and we have had discussions with the car companies: Please give us one test data that suggests that if you use E15 for 2001 in your vehicles, that will have an impact on the 100,000 durability of the emissions control systems. There is not a single——

Chairman HARRIS. It doesn't make a difference whether it affects that system. If that system fails, the auto company, under contract with an individual, the individual knowingly put E15 in there because maybe that was all that was available, the company legitimately can say we are not covering that system under warranty. You knowingly put a fuel in that your owner's manual said you shouldn't be putting in. I understand that you say you think it won't adversely affect the system, but the auto company doesn't care. If that system fails for another reason, a piece of plastic broke in the EGR valve, they are not under obligation if you have put the—is that my reading of the warranty?

Ms. OGE. May I answer?

Chairman HARRIS. Sure.

Ms. OGE. No, it is not. The dealer or manufacturer will have to demonstrate that indeed it was the fuel that caused the impact on the catalytic converters.

Chairman HARRIS. I think you give way too much credit for what gets refused under an automotive warranty, and anybody that has brought a car to a dealer under an automotive warranty I think understands what I am talking about.

Anyway, I will recognize Mr. Miller.

Mr. MILLER. Thank you, Mr. Chairman. Ms. Oge, I understand that there are different fuels in use now. Obviously, it is a big mistake to put diesel fuel in your car if you don't have a diesel engine. But there are other fuels in widespread use, is that correct?

Ms. OGE. Yes, it is.

Mr. MILLER. Okay. And some are appropriate for some engines and not for others?

Ms. OGE. Yes.

Mr. MILLER. And how much of a problem has EPA discerned that there is with misfueling?

Ms. OGE. That is a very good question actually. In 2006, EPA mandated actually that diesel fuel contains low sulfur levels, from 500 parts per million to 15 parts per million. So we mandated a cleaner diesel fuel because the new diesel truck engines introduced in the marketplace could have impacts on emissions control systems if higher diesel fuel goes into this new marketplace.

So the agency used similar procedures that we are using here for E15, for misfueling labeling, to make sure that there is appropriate product transfer, documentation from point A to Z.

So to answer your question, we have had very good experience with the clean diesel fuel in 2006, where actually the consumer if used the old diesel fuel could have impact, severe impact, to their engines, not just in emissions control systems, but also to the engine itself.

Mr. MILLER. Okay. I am one of those who voted against implementing this rule immediately for the next year, and the reason was concern about emissions. And as Ms. White acknowledged in her testimony, the Environmental Working Group usually supports the work of the EPA, but you all have parted company on this issue, and with respect to the effect of E15 on emissions of vehicles 2001 and newer, do emissions for those vehicles using E15 stay within the EPA minimum emission standards?

Ms. OGE. Yes, it does. Actually, the data shows that emissions for nitrogen oxides using E15 will increase. Emissions for hydrocarbon, CO and benzene will decrease. But also under the 2007 Energy Independence and Safety Act, Congress has requested that EPA evaluate these potential increases and take steps to reduce those increases. And EPA is in the process of doing that with a new program that we are developing under the direction of our President to reduce emissions for both fuel and cars to address this issue.

Mr. MILLER. And I am sorry, your rules allow you to kind of swap off emissions that if formaldehyde goes above levels and something else goes below that you can kind of trade it around?

Ms. OGE. No. Our rules require—the waiver decision is based on demonstrating that the vehicles and engines in which E15 is going to be allowed to use, this E15 will not cause or contribute to the emissions of those vehicles failing. Our determination clearly shows that 2001 or newer vehicles will continue to meet those standards. However, overall, there will be some increases still meeting the standards. There will be some increases on nitrogen oxide. There will be decreases on hydrocarbon and CO and benzene. Congress has directed us to make sure that we net out those increases, but the standards will still be met.

Mr. MILLER. Ms. White, do you wish to be heard on this point?

Ms. WHITE. Yes, I think the point really is looking at the Department of Energy tests that EPA based at least part of its waiver decision on for model years 2001 to 2007. At least 50 percent of the cars that they tested failed at least one emissions standard. And then when we looked at 2007 or newer cars, at least 20 percent of the cars tested failed.

So we are obviously concerned about the emissions. Whether or not the balancing test under the EPA regulations pans out, the fact that there was a small number of cars sampled and that there were high rates in our opinion of failure for really serious emissions that we are talking about. We are talking about formaldehyde, for example, which is a known carcinogen, and there are really serious public health implications here.

I think one of the questions that we don't know the answer to is where are these older model cars? Where are we going to see impacts in air pollution?

Mr. MILLER. Of course it would be useful to have the Department of Energy here to address this issue. Mr. Chairman, it is peculiar that, you know, a hearing about ethanol, we have a witness from the petroleum industry but not from the ethanol industry. We have, however, received a letter from the Renewable Fuels Association which is the trade association for the ethanol industry. With-

out embracing the contents of the letter as my own, I would like to enter this into the record of the hearing out of simple fairness.

Chairman HARRIS. Without objection.

[The information can be found in Appendix II.]

Chairman HARRIS. Now, I do want to ask unanimous consent to add four items into the record as well. These items are in the public domain and shared with the minority.

Number one is EPAs partial grant and partial denial of Clean Air Act waiver application submitted by Growth Energy to increase the allowable ethanol content of gasoline to 15 percent. In the light of the Renewable Fuel Association concern, I note the EPA's decision makes it very clear that the Agency did not rely upon the Renewable Fuel Association study. EPA said that RFA study simply "conducted a literature search of existing information" already cited and "did not perform any emissions or durability testing."

The second item is the subsequent partial grant of Clean Energy Act waiver application submitted by Growth Energy to increase the allowable ethanol content of gasoline to 15 percent. The decision of the Administrator, that is from the Federal Register, January 26, 2011.

Letter dated March 26, 2009, sent from over 40 business, environmental, taxpayer, free market and public health groups to Administrator Jackson and other Administration officials asking that any waiver decision on E15 heed President Obama's memorandum on "scientific integrity."

And finally, a joint letter from the American Motorcyclists Association and the All-Terrain Vehicle Association dated July 6, 2011, sent to Ranking Member Miller and me in support of the discussion draft language considered at this hearing. Without objection, so ordered.

[The information can be found in Appendix II.]

Chairman HARRIS. I want to recognize Dr. Broun.

Dr. BROUN. Thank you, Mr. Chairman. Ms. Oge, why did the EPA and the Department of Energy choose to fund the E15 research to support the waiver petition rather than asking the petitioners themselves to pay for the necessary research? It is my understanding that previously all other petitioners, the EPA has insisted that the petitioner pay. Why did you all use taxpayer's dollars to do this research?

Ms. OGE. Sir, I think this question should go to Department of Energy. EPA did not fund the study. We worked with them.

Dr. BROUN. You all didn't have any decision——

Ms. OGE. No funding.

Dr. BROUN. Okay. In EPA's decision document, for the first E15 waiver, EPA dismissed the CRC engine durability test program stating that the data provided up to that point in time only pertained to E20 blends. This ongoing program has recently identified potential engine failures on E15. How will the EPA consider this new information with respect to the waiver?

Ms. OGE. Sir, the DOE program was designed with participation——

Dr. BROUN. How will you all consider this, though? Will you have failures——

Ms. OGE. We believe that the Administrator made the decision based on the best record, which was the Department of Energy's statistically significant developed study and other data that EPA has. We have test cars, we have thousands of certificates. We are aware of the four studies that CRC is doing. Those studies, however, are not designed to answer the question in front of the Administrator——

Dr. BROUN. Ma'am, I apologize for cutting you off. I just have three minutes left.

Mr. Greco, do you want to respond to that?

Mr. GRECO. Yeah, a couple things. I think she was about to say the DOE program was designed to address these emissions. As I mentioned, EPA did not properly use the DOE research program. It was designed to test catalyst durability which is one particular set of parameters to stress the catalytic converter. If you want to stress the engine, you are going to design a test program differently. EPA with DOE inappropriately utilized a catalyst program to break down the engines and draw conclusions about engine durability. We let EPA know at the time and DOE that was an inappropriate way to go forward, that we had designed a more thorough and more robust program, but they decided not to go that route.

Dr. BROUN. So they didn't use good scientific integrity. Speaking of scientific integrity, in March 2009, Lisa Jackson was sent a letter from a diverse coalition. More than 40 businesses, environmental, taxpayer, free market and public health groups that called on EPA to heed President Obama's memorandum on scientific integrity. The key tenet of these principles is that agencies should not dismiss scientific information associated with public policy decisions.

If oxygen sensors are found to fail because of E15 exposure, will EPA rescind its waiver determination?

Ms. OGE. Sir, we are not here to guess, and I would not answer. The only thing I have to tell you is that the series of studies that you are referring are not designed appropriately the way that the DOE extensive, sound, robust study was designed. Therefore, the results, if they show failures, are not going to be viewed in the same light as a well-designed scientifically robust study, the Department of Energy study.

Dr. BROUN. On June 2008, EPA staff gave a presentation that outlined what it would take to grant a waiver for mid-level ethanol blends. In that were recommendations that included the need of testing of all types of emissions, and the tests should be completed on medium-duty vehicles, heavy-duty vehicles, motorcycles as well as non-road engines across nine different equipment categories from hedge trimmers to snowmobiles. Did you all do that?

Ms. OGE. Sir, there is not any sufficient data. That is why the Administrator——

Dr. BROUN. You all didn't——

Ms. OGE. Excuse me. Let me finish. That is why the Administrator is prohibiting the use of E15 for those vehicles. Medium- and heavy-duty gasoline——

Dr. BROUN. You all didn't do that.

Ms. OGE. —vehicles—

Dr. BROUN. My time has about run out. Now obviously, you didn't do that. The EPA staff made those recommendations. You just neglected even the EPA staff's recommendations on this, which is intolerable as far as I am concerned. I am the Chairman of the Investigations and Oversight Committee, and we particularly have been interested in scientific integrity. You all are not doing that. You are not heeding the President's recommendations to use scientific integrity, and frankly, when I go to a gas station for my boat, for my chain saws, for my weed whacker and those types of things, E10 is bad for those things and E15 is going to be disastrous for all those things. This was a terrible decision that you all made, and I hope that you all will go and consider the scientific and use scientific integrity because you have not done so in a rush to try to produce this wavier.

Mr. Chairman, my time is up. I will yield back.

Chairman HARRIS. Thank you, Doctor. Mr. Tonko?

Mr. TONKO. Thank you. Before I ask my question, is it possible to get a 1-minute response or 30-second response from Ms. Oge?

Chairman HARRIS. Your clock is running.

Mr. TONKO. It is. Did you want to respond? I just thought you had some response. I was going to give you 30 seconds of my time.

Ms. OGE. The agency is not required by law to do testing to make the case for off-road equipment. The agency had sufficient information, scientific information, to be concerned about off-road equipment, to be concerned about medium- and heavy-duty gasoline engines and to be concerned about motorcycles. That is why the agency is prohibiting the use of E15 in the marketplace.

So we use the right science in a very robust, scientific process to make these decisions.

Mr. TONKO. Thank you. Several of you have mentioned in your written testimony that you believe the Federal Government should be supporting renewable fuel research. Perhaps specifically to Mr. Burke and Ms. White, what kind of research would you recommend the Federal Government to fund to overcome the blend wall issue? Mr. Burke?

Mr. BURKE. Two main areas. The first, self-evident. Research in every technology that will, in coming decades, yield every possible liquid fuel from every possible source, either land-based or those such as algae, municipal waste and whatever.

Second, more subtle, more challenging but historically necessary as to some degree our content today reveals. Fund research at the juncture of overlapping sectors and overlapping technologies. We have a juncture in liquid transportation fuels with not only the existing petroleum industry but with, as we have heard today, equipment, resources, other technology. Historically and inevitably, new technologies butt up against what is already at hand. And to some degree, we are remiss both in our success and in our responsibilities if we don't fund research at the point of juncture.

Mr. TONKO. Ms. White, please?

Ms. WHITE. Yes. Thank you, Representative. We think it is really important to invest in drop-in biofuels that do not require any—that can use the existing infrastructure, do not require special pumps, et cetera.

We also think it is important to take a lesson from corn ethanol. We don't want to repeat the mistakes that we saw where there needs to be a precautionary principle with respect to advanced biofuels. We would like to see more research into swtitchgrass and some miscanthus as well as into algae. But we really think that we would need to constantly reassess the amount of money we are putting into the advanced biofuels to make sure we get where we want to go.

Mr. TONKO. Thank you. And Mr. Burke, North Carolina and my home State of New York have a lot in common as it relates to biomass resources. They are both large agricultural states, and we both have substantial forest resources.

Do you have any recommendations for New York on how to drive economic development through sustainable feedstock production?

Mr. BURKE. Yes, sir. If we in North Carolina and New York and beyond will successfully gain our expected new biofuels in coming years. The drawdown, the use of our natural resources will be extraordinary, unprecedented and greater than we can probably even begin to anticipate.

As such, we must merge technology, economic thinking and environmental responsibility to begin to effectively determine not just what we can quickly harvest or grow but what equally important we can sustainably grow and keep on the ground well into the future. It is possible that we will not need to only be attentive to sustainability and environmental implications, we will very possibly need in coming years to use biotechnology to purposefully alter various of our crop and forest resources so that they grow under the best conditions, with the best outcome, with minimal environmental degradation.

Mr. TONKO. Thank you very much. Mr. Chair?

Chairman HARRIS. Thank you very much. I now recognize the Chairman of the Committee, Mr. Hall.

Chairman HALL. Thank you, Mr. Chairman. Mrs. Oge, I think the Chairman started out the questions here. I would like some inquiry. Have you relied partial waiver decision under Section 211(f) of the Clean Air Act in regard to mid-level ethanol blends and gasoline? And I think you know that the auto industry along with the engine manufacturers and the oil industry expressed a lot of concern about EPA's permitting up to 15 percent ethanol in gasoline and that it may have a negative consequence. I think the Chairman clearly pointed that out to you on engine performance, emissions and also create a situation where misfueling by consumers might occur. You understand that, don't you?

Ms. OGE. Yes.

Chairman HALL. Then let me ask you this. It is my understanding that EPA is proceeding though with the rule-making on tier three. I don't think anybody has asked you about tier three, have they today?

Ms. OGE. No.

Chairman HALL. And you know what I am talking about, don't you?

Ms. OGE. Yes, I do.

Chairman HALL. This would impact the sulfur content in gasoline as well as the reid vapor pressure of gasoline. What on earth is the justification for proceeding with the rulemaking at this time?

Ms. OGE. The tier three rules that you are referring to, sir, is a regulation that has two drivers. One is the existing ozone NAAQS for both ozone and PM, and the second is actually the Energy Independence and Security Act that requires EPA to evaluate the potential impacts of 36 billion gallons of renewable fuel in the marketplace, and if we determine that there are increases in emissions from the use of the 36 billion gallons to take steps to reduce those increases.

The agency is in the process of developing such a rule, but I am not allowed at this point to give you any details because no decisions have been made. We are in the process of talking to the car companies, talking to the oil industry and we are in the process of developing this regulation.

Chairman HALL. Well, as you know, Section 209 of the Energy Independence and Security Act of 2007 required EPA to complete a study 18 months after enactment to determine whether, quote, the renewable fuel volumes required by the RFS2 will adversely impact air quality before proceeding with any rulemaking. The statute even further provides that you might determine additional rulemaking is not even necessary. Yet, in September of last year, Assistant Administrator for Air and Radiation, Regina McCarthy, told Congress EPA was carrying out some of the long lead-time work needed to perform the anti-backsliding analysis required by Section 209 and noted that EPA would incorporate the results of our analysis under the Section 209 assessment in the proposed long new vehicle and fuel control measures.

So in other words, EPA failed to complete the Section 209 study by the statutory deadline, did you not?

Ms. OGE. The studies as Ms. McCarthy said would be part of the tier three proposal. Also I may note that when we finalized the RFS2 program a couple of years ago, we did put a preliminary analysis of the potential impacts of—

Chairman HALL. Well, did you or did you not—excuse me. Did you or did you not fail to complete the Section 209 study by the statutory deadline?

Ms. OGE. We have not completed—

Chairman HALL. Just tell me yes or no.

Ms. OGE. Yes, sir.

Chairman HALL. All right. And as the study is not yet completed, when do you expect to complete the Section 209 study?

Ms. OGE. At the end of this year.

Chairman HALL. And do you expect to provide an opportunity for comment on the results of the study prior to the incorporation of the results into a proposal on new vehicle and fuel control measures?

Ms. OGE. That will be part of the proposal that will go out for the purpose of comments.

Chairman HALL. We will be studying that further, and we will study the record that you are making here and that others from the EPA have made before this Committee.

I might caution you to understand that this Subcommittee expects a full explanation why this statutory deadline has been ignored and why it seems EPA is moving forward with control measures prior to completion of even a single study mandated by Congress. You know what that means, don't you, when you are mandated by Congress? Why can you just disobey that and ignore it?

Ms. OGE. Sir, we have not ignored it. We are late in completing the study, and are going to do that by the end of the year.

Chairman HALL. Well, my time is running out, but I think it is only fair to let you know that you may be back before us again. It seems that there is a pattern of regulating in this area before the necessary and appropriate scientific analysis and testing is performed and reviewed.

I think perhaps you are going to hear from Mr. Sensenbrenner and from Dr. Broun in the future. I thank you, and I yield back my time.

Ms. OGE. Thank you.

Chairman HARRIS. Thank you very much, Mr. Chairman. Mr. Bartlett?

Mr. BARTLETT. Thank you. Mr. Burke, I noted your observations about we were going to need all of the alternative liquid fuels that we could get. I am sure you are aware of the IEA reports of '08 and 2010 indicating that for the last five years, the world has been stuck at 84 billion barrels of oil a day, and their projections for the future are that productions from our current fields are going to decrease quite dramatically.

You know, if you are wildly optimistic about all of the alternative liquid fuels and add them up, they can't even come close to 84 billion barrels a day. So thank you very much for your recognition of the challenges that we face there.

Ms. Oge, I want to make the point that if you were really interested in the environment, you would certainly not have given a waiver for E15. You would have recommended that we not even have E10 because I don't think there is any justification from an environmental perspective for having E10.

You are familiar I am sure with the National Academy of Science report that said that at the year of their report, if we had taken all of their corn and converted it into ethanol that it would have displaced just 2.4 percent of our gasoline. They noted I think quite correctly that we could have saved as much gasoline by tuning up our car and putting air in the tires as we would have saved by converting all of our corn to corn ethanol. You are familiar with that study?

Ms. OGE. Yes, I am.

Mr. BARTLETT. Okay. You are also familiar with the studies that have indicated that the energy that goes into producing ethanol may be very close to the energy that we get out of ethanol? When you look at all of the inputs for instance about half the energy used to produce corn comes from natural gas in which nitrogen fertilizer is made. So there may be little or no increased energy available as a result of using ethanol which means that there may be no diminution in the CO_2 footprint. You are familiar with those studies?

Ms. OGE. I am familiar with the studies that we have done as part of the RFS and the ones that Congress requires to do for our own life-cycle analysis.

Mr. BARTLETT. Yeah, there have been studies which have indicated that there is really, it may actually be negative. It may take more energy to produce it than not. But even if it is mildly positive, what happened when we produced all that corn for ethanol, we planted where we shouldn't have planted. We took fields out of reserve and we put them in cultivation. There has been increased erosion.

Today for every bushel of corn that we grow in Iowa, three bushes of topsoil go down the Mississippi River. So even with our really good cultural practice, really good compared with yesteryear, it is still not sustainable. You can't have three bushels of corn go down the Mississippi River, three bushels of topsoil for every bushel of corn.

The next thing that happened was that we diverted acres from wheat to corn. Corn is a huge hog when it comes to using energy, is it not? And so now there was less wheat available, and we had a drought in the place where they produce rice, so less rice was available.

So there was an increase in the basic foods for everybody in the world, part of that laid at our doorstep because of this silly corn ethanol program.

If you were really interested in the environment, why wouldn't you recommend that we do away with E10?

Ms. OGE. Sir, I worked for EPA for 32 years. I am a public servant. I am not a political appointee, and I pride myself that every day I wake up I make a difference. I don't make the laws. Congress does. We have a law in 2007——

Mr. BARTLETT. But when we say something dumb——

Ms. OGE. No, excuse me.

Mr. BARTLETT. —don't you feel some obligation to tell us we are doing something dumb——

Ms. OGE. No——

Mr. BARTLETT. —and our support of ethanol is something dumb.

Ms. OGE. The Congress passed a law, the President signed it. We are implementing the law. As public servants that is all we can do, and we have to use the best science and legal justification for the decision we are making. And again, I feel pretty strong that the Administrator made the best scientific basis for this waiver decision. But I will not comment about policies on ethanol.

Mr. BARTLETT. But I thought that you were there to protect the environment——

Ms. OGE. And I am——

Mr. BARTLETT. I don't think the use of corn ethanol protects the environment. Would you argue me that it does protect the environment?

Ms. OGE. Sir, I am at EPA to implement the laws that Congress passes. Congress passed a law in 2007, and we are implementing it as Congress has required based on the best science and legal criteria available to us.

Mr. BARTLETT. So you are doing as little harm as possible to implement the laws that we shouldn't have passed. Is that what you are saying?

Ms. OGE. I am not going to comment on that.

Mr. BARTLETT. Thank you. I yield back, Mr. Chairman.

Chairman HARRIS. Thank you very much, Dr. Bartlett. Mr. Sensenbrenner, the Vice-Chairman?

Mr. SENSENBRENNER. Thank you very much, Mr. Chairman. To begin with, I would like to submit for the record a letter which I sent to Administrator Jackson dated yesterday with all of the letters that I have received from both large-engine and small-engine manufacturers.

Chairman HARRIS. Without objection.

[The information can be found in Appendix II.]

Mr. SENSENBRENNER. Now, Ms. Oge, I think we have seen pretty adequate testimony that E15 will reduce fuel efficiency while at the same time Congress has mandated an increase in fuel efficiency. Isn't the EPA kind of working across purposes by having E15 at the same time there has been a Congressional mandate? Remember, I have only five minutes, too.

Ms. OGE. You are right. Let us also——

Mr. SENSENBRENNER. Okay. I am right. Fine. Thank you.

Ms. OGE. No, I didn't say that.

Mr. SENSENBRENNER. Okay. Now——

Ms. OGE. Can I clarify it?

Mr. SENSENBRENNER. Now, let us go on. Okay. We heard from both Ms. White and the letters that I have received that E15 will void the warranty. Most car engines will wreck practically all of the smaller engines. And yet at the same time, there is no mandate from the EPA that gas stations continue to provide E10. Now, if you have a small engine for Dr. Broun's boat or Dr. Harris' lawnmower or Mr. Palazzo's snowmobile in Mississippi, where are they going to find the fuel that doesn't wreck their engines if there is not a mandate that E10 be available?

Ms. OGE. Sir, we are not mandating E15 to be used. Any E15 right now cannot be used until we register the fuel, so it is not a legal fuel. And there are many steps that need to take place at the state, local and Federal Government for E15 to be marketed.

When it does get marketed, we will be more than willing to take a look and see what happens to E10 because we agree with you that E10 is needed for off-road equipment and older equipment.

Mr. SENSENBRENNER. Well, you know, that is nice, but you know, I started driving around when the leaded fuel ban came, and there was more than a sticker on the gas pump. They actually made the fuel import or the fuel ducts narrower so that with the leaded fuel, you had a wide nozzle and an unleaded fuel you had a narrow nozzle. And still, according to the statistics, 20 percent of the vehicles were misfueled.

Now, how are you going to be able to do that without having gas stations to go to the extent of having separate pumps for E15 and E10 and some kind of a barrier to prevent the E15 from being put into engines that can only run on E10?

Ms. OGE. Sir, unleaded fuel as you will remember was mandated——

Mr. SENSENBRENNER. No, let us——

Ms. OGE. No, excuse me.

Mr. SENSENBRENNER. Yeah, well, let us look—I gave the example, you know, of the different size gas nozzles between leaded fuel and unleaded fuel when that mandate came. Now, if you have E10 and E15 at the same gas station, are you going to have to have separate pumps for that which is an expense of the gas station or are you going to have some kind of blockage so that E15 is not put into an engine that will only run on E10?

Ms. OGE. May I answer?

Mr. SENSENBRENNER. Yes.

Ms. OGE. We are not mandating E15 to be used. We mandated unleaded fuel because new vehicles introduced into the marketplace with catalytic converters, they would destroy those.

Mr. SENSENBRENNER. I understand that, but now we are talking about a fuel that can destroy a small engine and an engine in the car that has been manufactured since 2001. And I used the example of the mid-'70s where 20 percent of the cars were misfueled even with the barriers that were available. Now, you know, you better start thinking this through.

You know, I remember your visit to Milwaukee 15 years ago when the reformulated gas mandate came in, and as a result of some of your answers, the riot squad was being assembled in the parking lot across the street. And then you promised a hearing in Madison which you walked out of because you didn't like what the public had to say.

We are elected officials. We have to listen to what the public has to say, and I guess I am warning you that if you have a repeat of what happened back 15 years ago over reformulated gas, the public is a lot less tolerant and you better start looking at what the public thinks. This fuel doesn't help the environment, the fuel does have all the problems that have been stated, and the EPA ought to wake up and recognize that fact, rather than they being off in La La Land trying to impose another mandate from on high. And I yield back the balance of my time.

Chairman HARRIS. Thank you very much, Mr. Vice Chairman. You know, you are right. On the Eastern Shore of Maryland, they started selling good, old-fashioned gasoline so you can use it in your boats without any ethanol. The Chair recognizes Mr. Palazzo.

Mr. PALAZZO. Thank you, Mr. Chairman, for allowing me to sit in on your Subcommittee hearing. I think Congressman Sensenbrenner said it best in addressing the question about the damage it is going to cause anything E10 or above to chainsaws, lawnmowers, boats, snowmobiles, but for the record, I own a four-wheeler, not a snowmobile. To me, in this day and age, family budgets are tight, Americans are more busier now than ever. You know, distractions, hardships, things that just take their mind off what is happening, and I think most of these hardships, distractions and crises in American lives are basically generated by over-regulation and by a lot of the actions of the former Congresses.

So I am definitely concerned about misfueling and things of that nature. But I think that was pretty much asked and answered, especially with Mr. Sahu, his comment that over 500 million pieces of equipment could be damaged if they use E10 or greater or pos-

sibly even E10. A lot of people seem to think that has a lot of damage on small engines, and I agree. And up to $200 trillion in replacement just for those pieces of equipment, and that is just money American people don't have right now. And things are tight, and I just don't think we should be pushing what it feels like is more of a mandate on them.

But my question for Ms. Oge is centered around the infrastructure concerns. My understanding is that the Underwriters' Laboratory has not certified any existing fuel pumps to handle E15. Additionally, Underwriters' Laboratory, along with the National Renewable Energy Laboratory, conducted extensive testing on the use of E15 in new and used fuel dispensing equipment, like hoses, valves, pump and nozzles. The testing was completed in November 2010 and showed that more than 50 percent of used equipment, and more than 30 percent of new equipment, failed when used with E15. Were these major infrastructure concerns considered by the EPA?

Ms. OGE. Sir, I think I am familiar with the study that you are referring to. There was a Department of Energy sponsored study. Again, the Clean Air Act under 211(f), the Administrator in looking at this waiver, has to determine to what extent a new fuel or fuel additive would impact cars or contribute to emissions control of that vehicle failing. EPA is not responsible for dispenser units. As you know, a lot of state and local governments have that responsibility, and as I mentioned earlier, before E15 becomes a commercially available fuel in the marketplace, first we have to register this fuel. To date EPA has not received a full application from the renewable fuel producers on behalf of them, so it is not registered, therefore it is not legally allowed to enter the marketplace.

The second issue has to do with underground storage tanks. EPA just put out a guidance. There are issues of potential compatibility of materials, based on the rating of dispensing units, plus, there are 30 or 35 states that have ASTM laws that require changes from E10 to 15.

So what I am trying to say is that there are a lot of steps that need to be taken that EPA is not responsible for before E15 is marketed.

Mr. PALAZZO. Is there some form of timeline before this may be registered? I mean, because everybody assumes it is barreling down the road, so is this two years, three years. And you also mentioned that the states and local governments are responsible for the infrastructure. I mean, they are broke, too, so how are we going to ask them to pick up the costs or who do you expect to pick up the cost at the end of the day?

Ms. OGE. So the first question about registration, we have received some data from the renewable fuel producers. We don't have the full records, and we don't have the formal application from them so I cannot give you a timeframe.

As far as dispensing units, retail stations have to meet local and state government regulations on compatibility of dispensing units, and the same thing for underground storage tanks. So it will vary from station to station, from state and local government laws.

Mr. PALAZZO. This is just open for everybody. I know everybody is focused on Ms. Oge, and hopefully I have a few extra seconds and won't get gaveled out.

Does America have an energy policy? Does anybody want to try to tackle that in 15 seconds or less? It is pretty simple. One, stop the government policies that drive up the cost of energy because our economy and national security is dependent upon affordable and available energy. Second is expand domestic energy production. That is American energy, so open up the East Coast, the West Coast the off-shore, on-shore, Alaska, the Gulf of Mexico, and drill. Three things will happen. We will reduce our dependence on foreign oil, we will drive down the cost of energy and we will create American jobs. And three, promote an all-the-above approach, oil, nuclear, coal, natural gas. Heck, I am okay with wind, solar and water and anything else you can think and biofuels as well as long as it is not subsidized by the American taxpayer. Mr. Chairman, thank you.

Chairman HARRIS. I thank you very much. Before we adjourn, we are going to have one more five minutes for each side, and the minority is trying to round up a Member for their five minutes, but I am going to recognize myself for five minutes to start the truncated second round.

First of all, I just want to make a comment that there were some questions about the appearance of DOE at the hearing. Now, we don't think that it is necessary to have DOE because this is specifically about EPA making the ruling using that information. It is not whether the DOE study was adequate or inadequate, it is basically whether it was done scientifically. It was whether EPA needed more information in order to make this instead of just depending on that study.

Now, let me ask Mr. Wasil, I got a question for you because I do have a marine engine, and I will tell you, there is great fear about putting any ethanol at all into those engines. So literally, there are places now popping up that sell good, old-fashioned, 100 percent gasoline to put into which is a little pain because, you know, your marinas don't have it. You got to get it from a gas station. It is a whole other mess. But anyway, I remember back in the '70s when we first talked about putting ethanol in, and I would rebuild a carburetor. They would say, look, you can't use ethanol in it because it affects the gaskets. Is that one of the concerns, the effect of ethanol on gaskets in an engine?

Mr. WASIL. Sure, absolutely that is a good point. Many of the components, fuel system components, on the engines themselves are susceptible to damage from ethanol.

Chairman HARRIS. Okay, and thank you very much because I got to keep it short.

Mr. WASIL. Okay.

Chairman HARRIS. Ms. Oge, did the EPA test gaskets? I mean, because gaskets, they degrade over time. It could take two years, three years for that gasket to fail, and the failure of a gasket in a fuel system can be a catastrophic event, not only for the environment because it leaks gasoline at that point, but obviously it leaks gasoline, I mean, around a hot engine. Did the EPA consider how long a period you would have to study a gasket in a fuel system

or an emissions control system before you can say confidently increase in the ethanol concentration will not adversely affect that gasket performance?

Ms. OGE. The DOE study of the 19 models, they tested each one of these models, about 88 cars, 120,000 miles. Also, they took some of the engines and they broke them up.

Chairman HARRIS. But excuse me, they tested over what period of time?

Ms. OGE. One hundred twenty thousand miles——

Chairman HARRIS. Over what period of time?

Ms. OGE. Six months to a year.

Chairman HARRIS. Okay. Ms. Oge, you do realize that there is a time dependency of the wearing away of a gasket with exposure to ethanol?

Ms. OGE. Sir, there are test procedures. When a company certifies a car, there are test procedures that EPA determines for the car company to demonstrate that the vehicle would meet the environmental standards for its full useful life. So this similar test procedures of car companies are using today in short periods of time to determine and to demonstrate that their cars would last——

Chairman HARRIS. But Ms. Oge, they are testing for E10.

Ms. OGE. Sir——

Chairman HARRIS. You are testing for E15. My question is simple. Did you all insist on a scientific test that lasted as long as the life of a car would last?

Ms. OGE. Sir, we test at E0 and E15. We had one car that failed E0, and three cars—three cars that failed I believe E0 and two cars that failed E15. The same test protocols that were used for E0 for the 120,000 miles that car companies are using to demonstrate that the car would last for 120,000 miles——

Chairman HARRIS. Okay. I am not worried about the entire car.

Ms. OGE. —for 10 years.

Chairman HARRIS. I am worried about——

Ms. OGE. Sir——

Chairman HARRIS. —a gasket failure——

Ms. OGE. Sir, I am telling you, we use the same test procedures that the car company has to use when they certify that their gaskets and their emissions control systems would last for 120,000, eight years or 120,000 miles. The same test procedures were used by the Department of Energy. If you are interested to know more details, we would be glad to provide that for——

Chairman HARRIS. I would be very interested in knowing how you tested the gasket because it is my understanding that you test catalysts. You tested catalysts performance. I don't understand. Does that mean what comes out of a catalytic converter at the end?

Ms. OGE. Actually we tested catalyst performance but also there were a number of models that were chosen where the engine was broken down for both E0 and E15 and they take a look at, you know, what extent there are valves that are affected, hoses, the engine is affected. And we found similar impacts of E0 to E15 for those engines—

Chairman HARRIS. Well, I am shocked——

Ms. OGE. —and we would be glad——

Chairman HARRIS. —at that because I know ethanol does things to gaskets that gasoline doesn't.

Ms. OGE. I would be glad to share that information.

Chairman HARRIS. Thank you. I am going to recognize Dr. Bartlett for my last 30 seconds.

Mr. BARTLETT. If we have a second round, I will claim my own five minutes.

Chairman HARRIS. Well, Dr. Bartlett, we decided since there are no minority Members and they were trying to round up one, that would have five minutes. I will give you 30 seconds, but the gavel is not going to be very active. So take advantage of it.

Mr. BARTLETT. Thank you very much. I wouldn't want my disaffection with ethanol to be extrapolated into believing that I am not a supporter of alternative fuels. Mr. Burke, I was led to believe from some of your observations that you may be one of the exceptions that I refer to when I tell audiences that the innocence and ignorance in our country on energy matters is astounding, and with a few exceptions, we have truly representative government. I think you may be one of those exceptions.

I gather that you are familiar with the IEA.

Mr. BURKE. I think I will thank you for that, Dr. Bartlett.

Mr. BARTLETT. I meant it so, sir.

Mr. BURKE. Thank you, sir.

Mr. BARTLETT. You are familiar with the IEA projections of future oil production?

Mr. BURKE. Yes, sir.

Mr. BARTLETT. Okay. Do you believe that we are going to be getting 2/3 of all the oil that we pump just about 20 years from now from fields from which we are getting nothing now?

Mr. BURKE. I believe that all of our best estimations, prognostications and thinking are likely to be confounded in coming years by factors barely known to us about fuel usage worldwide and gaining usage worldwide.

In the light of such mercurial unknown changes in the future, we in North Carolina have determined that it is simply smart policy to grant that we need as much as possible of every kind of liquid fuel. We don't disavow petroleum from any source. It seems to us that in fuels as in other areas, dependency on a monosource is never a good idea. That is why we don't like monopolies, that is why we were fearful of a corn blight many years ago. Single source, not good.

So we are simply determining that provident future mongering suggests we should have the capability for as many kinds of liquid fuels as possible.

Mr. BARTLETT. I don't know how many of you are familiar with the corn blight that you talking about. I imagine that is the male Texas sterile cytoplasm that were used to sterilize the corn in hybrid corns so we wouldn't have to pull the tassels off, and it got a blight and we were threatened with having no corn the following year. So they went to the islands where they could grow two corn crops in a year so we had some corn seed at very high prices the next year. When was that, sir?

Mr. BURKE. I believe in the mid-'70s.

Mr. BARTLETT. Yeah. Well, that was a wake-up call when you get to a monoculture. You see, to produce hybrid corn, you tear the male part of it off, and that was a lot of work and sometimes you missed it. And when you missed it, that was a bad deal because then you didn't have hybrid corn.

So what they would do is they developed this male Texas sterile cytoplasm which made the male Texas things sterile, but they got a blight that affected only that. And that is the risk that we have in our world of moving to only milk from Holsteins, only eggs for lake horn chickens and so forth. You go to a monoculture, you run the risk that they may have a collapse and you may be in a real catastrophe. And that was kind of a wake-up call.

I appreciate your tolerance, sir. Thank you very much.

Chairman HARRIS. Thank you very much, Dr. Bartlett. Always learn something from your questioning.

I want to thank the witnesses for their valuable testimony and the Members for their questions. The Members of the Subcommittee may have additional questions for the witnesses, and we will ask you to respond to those in writing, and the record will remain open for two weeks for additional comments from Members. And again, I want to thank you for your patience. We ran late. The witnesses are excused. The hearing is adjourned.

Mr. GRECO. Mr. Chair, can the witnesses also provide information? I would like to correct a couple of erroneous comments.

Chairman HARRIS. Yeah, we will, in response to your questions. Thank you.

[Whereupon, at 4:35 p.m., the Subcommittee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Ms. Margo Oge, Director, Office of Transportation and Air Quality, U.S. Environmental Protection Agency

Questions submitted by Chairman Andy Harris

Q1. You stated that the DOE test data on catalyst durability was posted in the docket for parties to review and comment. Is it not true that only 5 weeks elapsed from when preliminary test data from the DOE Program was made available in raw form to when EPA made its initial waiver decision? Why did EPA wait until the day Administrator Jackson signed the initial waiver decision (October 13, 2010) before posting its technical analysis of the initial DOE Catalyst Durability Program to the Public Docket? Why didn't EPA reopen the comment period to allow sufficient time for others to truly review and comment on the DOE data?

A1. Beginning May 21, 2010, five months before the initial waiver decision, EPA submitted data from DOE's Catalyst Durability Program to the docket as the data became available and was checked for accuracy, and the public was allowed to review and comment on the data. In an April 20, 2010, letter to the Alliance of Automobile Manufacturers and in discussions with other interested parties, EPA explained that it would place new data and other information in the docket, continue to accept substantive comments on the waiver, and consider those comments in making a waiver determination. Over 90% of the data for model year (MY) 2007 and newer light-duty motor vehicles was available in the docket five weeks prior to the Administrator issuing the partial waiver covering those vehicles.

EPA posted the document, "Technical Summary of DOE Study on E15 Impacts On Tier 2 Vehicles and Southwest Research Teardown Report,"[1] on the day the Administrator signed the initial waiver decision consistent with its practice in all previous Clean Air Act section 211(f)(4) waiver decisions. This technical summary provides further elaboration of EPA's first waiver decision as set forth in the Federal Register notice of the decision. Providing a more detailed technical explanation of the Agency's waiver decision is analogous to the regulatory impact analyses and response to comment documents for rulemakings, which are also released to the public on the day that the final rule is signed.

We noted in the first waiver decision that an additional comment period was neither needed nor necessary.[2] Section 211(f)(4) of the Clean Air Act requires that EPA grant or deny an application for a waiver after public notice and comment. EPA published notice of receipt of the waiver application on April 21, 2009, and provided the public with an extended public comment period of 90 days to submit comments on the waiver application. EPA received approximately 78,000 comments during the public comment period.

As described above, EPA continued to accept comments on the waiver application after closure of the formal comment period. Over 300 individual comments representing a broad range of affected stakeholders and the public took the opportunity to submit additional comments in light of other comments and information included in the docket. EPA also held meetings in which stakeholders shared their comments, concerns and additional data regarding the waiver request. Information received at these meetings was made available in the public docket. In view of the access that had been made available to all of the information in the public docket, EPA concluded that there was no need for a second public comment period.

Q2. You testified that "The burden is on the waiver applicant to make the demonstration, although EPA considers information submitted by the public and other available information in making its waiver decisions." Please quantify the burden shouldered by Growth Energy in demonstrating the case for this waiver versus that borne by the Federal Government. Please also quantify the burden shouldered by applicants in past waiver requests versus that borne by the Federal Government. How do these proportions compare?

A2. We do not have information about the costs incurred by Growth Energy in preparing the E15 waiver application, so we cannot quantify the burden shouldered by Growth Energy versus that borne by the Federal Government in responding to the waiver application. We note, however, that in its waiver application Growth Energy presented a number of technical papers that covered vehicle testing of gasoline-

[1] "Technical Summary of DOE Study on E15 Impacts On Tier 2 Vehicles and Southwest Research Teardown Report," October 13, 2010. See Docket ID EPA–HQ–2009–0211–14019 at www.regulations.gov.

[2] See 75 FR 68094 (November 4, 2010).

ethanol blends, along with a discussion of why these papers supported granting the waiver. Since DOE was conducting testing that could address issues not resolved by the technical data presented by Growth Energy, EPA waited to make waiver decisions until DOE testing had been completed and assessed.

While DOE testing provided much of the data on which the partial waivers were based, it was not the first time that emissions data relevant to a waiver determination were developed by the Federal Government or sources other than the waiver applicant. For example, in 1978 EPA received a waiver application from a small company, Gas Plus, Inc., and the Illinois Department of Agriculture for E10. The application included a compilation of general papers on alcohol fuels and fuel blends. In that case, the Federal Government, two auto manufacturers and two refiners conducted some vehicle emissions testing on E10. In the context of the waiver application for MMT, a manganese-based gasoline additive, EPA and auto manufacturers conducted some vehicle emissions testing in addition to that sponsored by the waiver applicant. As a general matter, waiver applicants develop the bulk of vehicle emissions data supporting their application.

Q3. You stated in your testimony that the Agency has yet to receive or act on a complete E15 registration application.

a. Has EPA received any portions of a registration application? Has the Agency taken any action to assist applicants or potential applicants in ensuring completeness of an E15 registration application?

A3a. In February of this year, the Renewable Fuels Association (RFA) and Growth Energy submitted to EPA for review E15 emissions and health effects information for meeting fuel registration requirements. EPA is in the process of completing its review. To the extent the information is found sufficient, RFA and Growth Energy may make it available to fuel manufacturers in submitting fuel registration applications for E15. The fuel registration regulations call for fuel manufacturers to submit applications that include emissions and health effects information as well as other information specific to the manufacturer (e.g., estimated sales and additives that will be used in the fuel).

EPA routinely assists fuel registration applicants by answering their questions about the various application requirements and how the requirements may be met. We provided such guidance to RFA and Growth Energy as they prepared E15 emissions and health effects information for meeting registration requirements. When we find deficiencies with applications, we also routinely provide guidance to applicants on how to correct the deficiencies.

b. According to EPA's website, "health-effects testing is required. before a new product can be registered."[3] In light of concerns raised in testimony by Heather White from the Environmental Working Group and others, what health-effects testing will EPA require prior to registration?

A3b. EPA's fuel registration regulations include "Tier 1" and "Tier 2" testing requirements to provide information useful in identifying potential health and environmental effects of emissions of the fuel or fuel additive being registered. For E15, Tier 1 testing requires that an engine be run on E15 and the compounds in the exhaust be identified and measured. For any compounds not already found in the exhaust of E0, a literature search is required for information on the potential toxicological, environmental, and other public welfare effects of those compounds. Likewise, for evaporative emissions of E15, a literature search is required for any compounds not already found in the evaporative emissions of E0.

Tier 2 testing involves animal exposure to emissions of the new fuel or fuel additive. The regulations specify standard Tier 2 test protocols and also provide for "Alternative Tier 2" testing where the standard tests would not provide useful information. (For example, Alternative Tier 2 testing has been used for most gasoline fuels, including E10, because the exhaust emissions of the fuels contain carbon monoxide, the effects of which could mask or otherwise compromise the collection of meaningful information.) The fuel registration regulations further provide that Tier 2 testing need not be performed for a new fuel or fuel additive if it is determined that previously conducted tests provide information reasonably comparable to that which would be provided by appropriate Tier 2 testing of the new fuel or additive. In addition, the fuel registration regulations authorize EPA to require additional "Tier 3" testing as appropriate, including testing to address any issues raised by Tier I or Tier 2 test results or information available from other sources. Tier 3 testing can be required before or after a fuel is registered.

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[3] http://www.epa.gov/oms/additive.htm.

As noted above, EPA is in the process of completing its review of the sufficiency of the emissions and health effects information submitted by RFA and Growth Energy.

Q4. In a presentation by your staff[4] to the Committee staff and in a recent report by the Congressional Research Service,[5] the stated waiver criteria established by EPA in determining whether to authorize a new fuel includes an evaluation of the immediate and long-term impacts of the fuel in four areas: exhaust emissions; evaporative emissions; materials compatibility; and drivability or operability.

a. If EPA sets this criteria and found that there was not enough clear evidence to grant a single, non-bifurcated waiver, does this criteria need to be changed?

A4a. The four waiver criteria correspond to those ways in which a fuel or fuel additive may affect vehicle or engine emissions. They inform the kind of testing and analysis that may be needed to determine whether a new fuel or fuel additive will cause or contribute to failure of emission standards. The criteria are applied to each category of vehicle or engine for which a waiver is considered and were so applied in the case of E15. We believe the criteria remain appropriate for consideration of future fuel waivers.

b. Why did the Agency not require testing of pre-2001 model year vehicles? Why were evaporative emissions, drivability/operability, and materials compatibility not subjected to a separate testing program to satisfy these criteria?

A4b. As discussed in the first waiver decision, EPA had engineering concerns that pre-2001 model year motor vehicles may not be able to maintain compliance with emissions standards if operated on E15. No testing was conducted by the waiver applicants or any other entity to address those concerns, so EPA denied the waiver for those vehicles. Under the Clean Air Act, the waiver applicant has the burden of demonstrating that the waiver criteria are met through appropriate testing and/or engineering analysis. EPA is not required to conduct testing in order to supplement the information provided by the waiver applicant or public commenters.

As described in the two E15 partial waiver decisions, available test data, information and analyses adequately addressed the evaporative emissions, drivability/operability, and materials compatibility criteria for E15 for MY2001 and newer light-duty motor vehicles. Separate testing to address each criterion by itself is not necessary. Test programs, like DOE's, can be conducted to address several criteria, and other information and analyses may be sufficient to address one or more criteria, depending on the particular issues raised by a new fuel or fuel additive. EPA took into account all of the information before the Agency in determining that each of the waiver criteria were met for E15 use in MY2001 and newer light-duty motor vehicles.

Q5. In your testimony you mention that, in making decisions about fuel waivers, EPA can look at representative test programs or "a reasonable engineering theory about emissions effects." Similarly, in a November 2009 letter to Growth Energy, Assistant Administrator Gina McCarthy said that "our engineering assessment to date indicates that the robust fuel, engine and emissions control systems on newer vehicles.will likely be able to accommodate higher ethanol blends, such as E15."[6]

a. What is "a reasonable engineering theory" and what role did such a theory play in the E15 waiver decision?

A5a. EPA has previously described two approaches for demonstrating that a new fuel or fuel additive will not cause or contribute to motor vehicles failing to meet their applicable emissions standards. One approach utilizes reliable statistical sampling and fleet testing protocols such as that conducted by DOE for assessing the emissions impact of E15 on MY2007 and newer light-duty motor vehicles. An alternative approach is to articulate a reasonable engineering theory about the likely emissions effects of the new fuel or additive based on relevant and well-founded engineering and other scientific principles, and to support that assessment with confirmatory testing or other information. In other words, if a reasonable theory exists, based on good engineering information and judgment, which predicts the emission effects of a fuel or fuel additive, an applicant need only conduct a sufficient amount of testing or provide other data and analysis sufficient to demonstrate the validity of such a theory. In making a waiver determination, EPA reviews all of the material in the public docket.

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[4] "EPA Waivers," Briefing for Staff of Committee on Science, Space and Technology, June 23, 2011.

[5] Brent Yacobucci, "Intermediate-Level Blends of Ethanol in Gasoline, and the Ethanol'Blend Wall.'" R40445, July 1, 2011, 8.

[6] http://www.regulations.gov/#!documentDetail;D=EPA–HQ–OAR–2009–0211–13925.

As explained in the waiver decision documents, engineering assessments contributed to the bases for granting the partial waivers. For example, the partial waiver decision covering MY2001–2006 light-duty motor vehicles relied in part on an engineering assessment of the capacity of the emission-related systems of those vehicles to accommodate E15, and that assessment was confirmed by data from the DOE test program.

b. If an "engineering assessment" was guiding EPA's beliefs about the impacts of E15 before final test results from DOE were available, why was this assessment never released for public comment?

A5b. Since DOE testing of MY2007 and newer light-duty motor vehicles entailed reliable statistically significant sampling and fleet testing protocols, the results of that testing provided much of the basis for granting the partial waiver covering those vehicles. As EPA explained in the first waiver decision, those test results, which were made available to the public, confirmed EPA's engineering assessment that tighter applicable emission standards and test protocols likely led manufacturers to design vehicles capable of maintaining emission standards compliance on E10 and that those design improvements were sufficient to allow compliance on E15.

c. Please provide the Committee the engineering assessment cited by Assistant Administrator McCarthy in November 2009.

A5c. The engineering assessment referred to in the November 2009 letter to Growth Energy simply reflected the ongoing consideration of EPA engineering staff reviewing Growth Energy's waiver request, available test data, and other information. The full assessment and the bases for it were described in the final waiver decision document addressing MY2007 and newer light-duty motor vehicles.

Testing Programs

Q6. Did your staff attend meetings held on June 3, 2009, September 16, 2009, and May 5, 2010 to receive briefings on relevant Coordinating Research Council (CRC) research projects to examine the impact of mid-level ethanol blends on engines?

A6. Yes.

a. If so, and in light of EPA and DOE's previous involvement with the CRC test programs, why did EPA ignore the issues raised in these meetings with respect to emissions concerns and decline to wait for CRC to finish? Please answer in light of the fact that EPA had did not issue the waiver for nearly a year after the 270-day deadline outlined in Section 211(f)(4) of the Clean Air Act.

A6a. EPA addressed the issues raised in these meetings with respect to emissions testing and explained why it was not waiting for the completion of several of the CRC mid-level ethanol blends test programs before making the E15 waiver decisions. As explained in the first waiver decision addressing MY2007 and newer light-duty motor vehicles,[7] the Agency did not wait for the results of the ongoing CRC studies because the record was sufficient without the studies, and many of the studies were not designed to answer the specific question before EPA (i.e., would E15 cause or contribute to failure of emission standards). As explained in detail in the waiver decisions, the ongoing CRC research projects have significant design issues that undermine the utility of these programs for evaluating the E15 waiver, including but not limited to the following issues:

- No actual vehicle testing;
- No testing on baseline fuel (E0) to properly ensure that observed effects were based on the test fuel and not some other cause;
- Testing on E20 instead of E15;
- Testing using an "aggressive" form of ethanol that is not allowed under the waiver decisions and applicable fuel regulations; and/or
- Selection of vehicle test fleets that are not representative of the national fleet.

b. Will EPA revoke the waiver if the CRC mid-level ethanol blends test program identifies that E15 will cause or contribute to a failure of an emission control device in any 2001 or newer passenger vehicle?

A6b. As stated above, EPA does not believe that the ongoing CRC mid-level ethanol blends test programs are properly designed to answer the specific waiver question before EPA. Also, as outlined in the waiver decision documents, the record is sufficient to partially grant the E15 waiver request for MY2001 and newer light-duty motor vehicles. Therefore, EPA does not anticipate that the CRC test programs

[7] See 75 FR 68094 (November 4, 2010).

will yield results that would undermine the partial waiver decisions, particularly considering the numerous CRC testing issues discussed above.

Q7. During question and answers in the July 7 hearing you stated that the DOE catalyst durability study was designed to be "statistically significant." Please provide necessary information to demonstrate the statistical significance of the study design.

A7. EPA staff specifically outlined an example of an appropriate statistical sampling methodology for use in the design of waiver test programs to CRC and DOE at a June 4, 2008 meeting.[8] The methodology informs sample size and selection so that the test fleet adequately represents the national fleet for the relevant vehicle category. The DOE Catalyst Durability Study for MY2007 and newer light-duty motor vehicles generally adhered to the methodology outlined in this presentation and is sufficient in both scope and size to be used to evaluate criteria for making a waiver request determination. It should also be noted that the ongoing CRC mid-level ethanol research programs do not adhere to this statistical sampling methodology and generally entail smaller and less representative test fleets.

Q8. A June 2011 General Accountability Office report,[9] which was reviewed by EPA officials, outlined the status of DOE and EPA-sponsored ethanol blend research in the table below:

[8] Simon, Karl. "Mid Level Ethanol Blend Experimental Framework—EPA Staff Recommendations" presentation to API Technology Committee Meeting, Chicago, IL (June 4, 2008). See EPA Docket #EPA–HQ–OAR–2009–0211- 2559.2 at www.regulations.gov.

[9] Government Accountability Office, "BIOFUELS: Challenges to the Transportation, Sale, and Use of Intermediate Ethanol Blends," June 2011, http://www.gao.gov/new.items/d11513.pdf.

Table 2: Status of DOE- and EPA-Sponsored Research on Effects of Intermediate Ethanol Blends in Automobiles and Nonroad Engines

DOE project number[a]	Description	Status (as of Mar. 1, 2011)
Research on automobiles		
V1	Short-term "quick-look" emissions study	Completed. Published reports: • NREL, ORNL, *Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines*, Report 1 – Updated (Golden, Colo., February 2009). • Keith Knoll, et al., "Effects of Mid-Level Ethanol Blends on Conventional Vehicle Emissions" (paper presented at SAE 2009 Powertrains Fuels and Lubricants Meeting, San Antonio, Tex., November 2009).
V2	Detailed exhaust emissions study	Ongoing. Expected date for completion of testing is May 2011. Expected date for issuing a report is October 2011.
V3	Evaporative emissions study	Completed. Published reports: • Harold Haskew & Associates, Inc., *Evaporative Emissions from In-Use Vehicles: Test Fleet Expansion* (CRC E-77-2b) Final Report EPA-420-R-10-025, a technical report prepared for the EPA, October 2010. • CRC, *Study to Determine Evaporative Emission Breakdown, Including Permeation Effects and Diurnal Emissions, Using E20 Fuels on Aging Enhanced Evaporative Emissions Certified Vehicles* (Alpharetta, Ga., December 2010).
V4	Full-life emissions study	Ongoing. Testing completed in December 2010. Expected date for issuing a report is summer 2011.
V5	Drivability study	Ongoing. Expected date for completion of testing is March 2011. Expected date for issuing a report is August 2011.
V6	Fuel-system materials compatibility study	Ongoing. Expected date for issuing a report is summer 2011.
Research on nonroad engines		
SE1	"Quick-look" emissions and temperature study	Completed. Published report: NREL, ORNL, *Effects of Intermediate Ethanol Blends*.
SE2	Full useful-life emissions and durability study	Completed. Published report: NREL, ORNL, *Effects of Intermediate Ethanol Blends*.
SE3	Chainsaw safety study	Canceled.
SE4	Marine and snowmobile durability, emissions, and drivability study	Ongoing. Expected date for completion of testing is March 2011 (for marine engines) and August 2011 (for snowmobiles). Expected date for issuing a report is October 2011.

Source: GAO analysis of DOE, EPA, and CRC information.

[a]CRC project numbers associated with these efforts include E-77 (for V3), E-87 (for V4), E-89 (for V2), CM-138 (for V5), and AVFL-15 (for V6).

a. Please explain why, in making partial waiver decisions in October 2010 and January 2011, EPA's decision relied heavily on a DOE test program that GAO characterized as still "ongoing" on March 1, 2011. Why did EPA not wait for a completed, publically-available, interpretive report on these tests that is expected in the summer of 2011?

A8a. Based on information from DOE, we did not anticipate that any additional data relevant to making waiver decisions would be provided in DOE's final report of its test program. In addition, EPA made the test data and relevant test design information available to the public prior to the waiver decision.

b. Please explain which of these completed and expected studies were included in EPA's evaluation of the E15 waiver, and a description of the relative weight afforded to each individual test program.

A8b. Please see attached table. It should also be noted that EPA considered a number of other studies in addition to those listed in the GAO table.

c. Will EPA re-examine the waiver decision when DOE issues reports on its detailed exhaust emissions study, full-life emissions study, drivability study, and fuel-system materials compatibility study? If not, why would EPA ignore these test programs that directly address EPA's stated waiver criteria?

A8c. For reasons described above and in the partial waiver decisions, we do not anticipate that the final reports on these test programs will provide new data or information that usefully addresses the specific questions before EPA in evaluating the emissions impact of E15. The information before the Agency at the time it granted the partial waivers provides sufficient support for the waivers.

Q9. EPA evaluated engine "teardown" inspections of a subset of the vehicles tested in the DOE Catalyst Durability test program and concluded that there "were no apparent differences at the end-of-life between the motor vehicles that were operated on E15 and E0" and "there was no pattern that would suggest greater deterioration on E15." The DOE program included driving cycles and procedures designed specifically to age and observe fuel effects on the exhaust emission control systems, not the durability of the engine. Please explain why you believe that it is relevant and valid to extrapolate these operating conditions and procedures as the bases for drawing conclusions concerning the effects of E15 on powertrain system durability and materials compatibility.

A9. The DOE Catalyst Durability test program aged vehicles using the whole vehicle aging procedures defined in the emission durability regulations (40 CFR 86.1823–08). The vehicles were driven on chassis dynamometers or actual road surfaces for the full 120,000 mile useful life according to the standard road cycle. The severity of this cycle was designed to be greater than 90 percent of the distribution of emissions deterioration by selecting speeds and accelerations to be higher than the ninetieth-percentile driver. Since this is a whole vehicle mileage accumulation process, the entire vehicle, including the engine, fuel system, exhaust, and emissions components, were all exposed to E15 for the full mileage accumulation period.

Fuel Economy

Q10. On March 11, 2011, before the House Subcommittees of Energy and Power and the Environment and the Economy, in reference to the House vote on H.R. 910, EPA Administrator Lisa P. Jackson stated: "I cannot, for the life of me, understand why you [Members of Congress] would vote to massively increase America's oil dependence."Please provide the basis, for the Administrator's statement by quantifying how many more barrels of oil America will import because of H.R. 910. Please take into account when answering that under H.R. 910, the Administration retains full authority to regulate economy under CAFE, and EPA retains authority to regulate vehicle air conditioner refrigerants under the Clean Air Act. Please include your precise methodology.

A10. As described in the 2012–2016 Joint Final Rule, under a harmonized [10] national program for greenhouse gases and fuel economy the Clean Air Act allows for significant additional fuel savings and greenhouse gas reductions beyond what is achievable under CAFE:

- EPA's Model Year 2016 standards are estimated to be equivalent to 35.5 mpg (if all the GHG reductions are from CO2 and not air conditioner refrigerants), while DOT estimated the 2016 CAFE standards would achieve a level of 32.7 mpg. The harmonized standards for Model Year 2012–2016 cars and light trucks will cause the oil consumption of the affected vehicles to be 1.85 billion barrels less than it otherwise would be. Of these significant oil reductions, one quarter, or 455 million barrels of oil (if all the GHG reductions are from CO2 and not air conditioner refrigerants), are unique to the EPA standards.
- The EPA GHG provisions also provide an additional 326 mmt CO2e reductions over the reductions that would be achieved from the affected vehicles if only CAFE standards were in place. This accounts for about one-third of the overall reductions of 962 mmtCO2e [75 FR 25490].

For the MY2017–25 standards, we also expect benefits for the EPA program in addition to the NHTSA program due largely to CAA flexibilities and the allowance under CAFE for manufacturers to pay penalties in lieu of achieving the full fuel

[10] EPA and NHTSA discussed their respective statutory authorities in detail in this rulemaking. See 74 FR 49454, 49460–467 (September 28, 2009). Under their respective authorities, both agencies consider the same or similar factors in setting standards, factors relating to the cost and effectiveness of control technology, lead time, the economic and other impacts of the program on the manufacturers, the need of the country for emissions reductions and conservation of energy, and the impact of other governmental standards. Each agency has significant discretion in weighing and balancing these factors in determining the appropriate standards under their respective authorities. The two agencies harmonized the joint rulemaking by adopting CAFE and GHG standards that reflect these statutory similarities and differences, and by establishing a common set of technical assumptions and analyses, for example on the cost to comply with the joint rule. For example, the air conditioning credits allowed under EPA's 2012–2016 GHG program provide an additional flexibility for automakers to achieve the standards.

economy standard. These additional benefits are not associated with EPA's authority under Title 6 of the CAA to regulate refrigerants. Rather, a portion of the benefits result from providing the automobile manufacturers the option of achieving part of the GHG reductions through the control of refrigerant emissions under Title 2 of the CAA. The precise estimate of those additional benefits will be included in the rulemaking proposal in the fall of 2011.

In addition, EPA's medium and heavy-duty truck GHG standards, finalized jointly with DOT's fuel economy standards on August 9, 2011 will achieve 22.1 billion gallons of fuel reductions over the lifetime of the heavy-duty vehicles built in 2014 through 2018 model years. DOT's program saves approximately 14.5 billion gallons. Therefore, the additional oil savings due to EPA's program is approximately 7.6 billion gallons of fuel, along with additional GHG savings of approximately 95 million metric tons of CO2. These additional benefits are largely a result of EPA standards taking effect in 2014. Given the four-year lead time requirement in the Energy Independence and Security Act, the fuel economy standards are not in force until 2016.

Q11. At that same March 11 hearing, Administrator Jackson stated: "The bill [H.R. 910] that passed the Committee would actually increase the amount of money that Americans have to pay for gasoline, diesel." Since the Administration touts that the next CAFE rule for MYs 2017–25 could save up to 1.3 billion barrels of fuel/ and under H.R. 910, the Obama Administration retains full authority to regulate fuel economy under CAFE, and EPA retains authority to regulate vehicle air conditioner refrigerants under the Clean Air Act, how it is possible that H.R. 910 will "increase the amount of money that Americans have to pay for gasoline, diesel"? Please include your precise methodology.

A11. The added fuel economy and greenhouse gas benefits of EPA action under the CAA as described in the response to number 10, above, would be lost. The net fuel cost savings over the life of the vehicle for the MY2012–2016 standards was $3,000. Had the standards only reached the "achieved level" of 32.7 mpg under CAFE, a significant portion of those savings would be lost. Again, a detailed analysis of the MY2017–2025 benefits will be included in the proposal, targeted in the fall of 2011.

Q12. Administrator Jackson stated that separate California fuel economy standards would create a "patchwork of state standards."[11] However, EPA refuses to consider the economic or environmental harm of the "patchwork" because arguments against the patchwork "are outside the scope of our section 209(b)(1) waiver criteria."[12]

a. What is the Administration's position on the "patchwork"?

A12a. The Administration does not have a position on this, but is aware of concerns on the part of the auto industry. As discussed below, the Administration has been successfully pursuing an approach to vehicle GHG and fuel economy standards that avoids a state patchwork.

b. Is EPA voluntarily powerless to stop California regulators from implementing its "patchwork"?

A12b. The section of the Clean Air Act that allows other states to adopt California's standards (section 177) is separate from the provision governing waivers for California's standards (section 209(b)). EPA's evaluation of California waiver requests is limited to the criteria listed in section 209(b) of the Act, and those criteria do not include other states' adoption of California's standards.

The current national greenhouse gas (GHG) emission and fuel economy program for MY2012–2016 light-duty vehicles is an example of and template for avoiding any patchwork of state GHG standards. Based on the MY2012–06 program, California has allowed automakers showing compliance with EPA's GHG standards to be deemed in compliance with California's GHG requirements. This has resulted in a truly national program for addressing vehicle GHG emissions and fuel economy.

EPA and NHTSA recently issued a Supplemental Notice of Intent (SOI) outlining the key program elements that EPA and NHTSA plan to propose for MY2017–2025 light-duty vehicles. The agencies coordinated extensively with California, and held discussions with other stakeholders, including automakers, states, and environmental groups, to ensure that the forthcoming proposal is based on the most robust technical analysis possible. Many automakers and California have announced their commitment to support the outlined program. California has publicly committed to

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[11] Administrator Lisa P. Jackson, Remarks at the National Press Club, as prepared (March 8, 2010).

[12] 74 Fed. Reg. 34754 (July 8, 2009).

taking the same approach as it did for the MY2012–16 standards, paving the way for the continuation of a coordinated national program.

Questions submitted by the Honorable F. James Sensenbrenner

Q1. In testifying before the Subcommittee, you stated "if the consumer uses E15 for 2001 in your vehicles, that warranty will not be impacted" and that EPA had talked to all the automobile manufacturers in the waiver process. In a May 5th hearing before the House Energy and Power Subcommittee, you also testified that "We are very confident that newer vehicles can use E15 gasoline blend."

a. When I contacted the automakers about E15, they shared their warranty information, which specifically prohibited the use of fuel over E10. These warranties state that using a fuel above E10 would constitute misfueling and result in the warranty being voided. How do you resolve the discrepancy between what you are telling this Committee and what the automakers are telling us? You state that EPA talked to the automakers when considering this decision, so why the inconsistency regarding warranty coverage for E15?

A1a. My testimony before the Committee is based on EPA's waiver decisions and the record for those decisions. The Clean Air Act test for granting fuel waivers requires EPA to determine whether available data and analysis demonstrate that a new fuel will not cause or contribute to failures of emission standards. It does not depend on what fuel manufacturers recommend in their owner's manual. For E15, EPA determined that the extensive data available on E15 emission impacts demonstrates that E15 will not jeopardize compliance by MY2001 and newer cars and light trucks.

In light of the available information demonstrating that MY2001 and newer vehicles will continue to meet emission standards on E15, we do not believe E15 use in these vehicles will result in damage or warranty claims.

It is also worth noting that EPA's waiver decisions and labeling rule do not change the terms of manufacturers' warranty provisions. Under EPA's regulations, manufacturers may condition their emissions warranties on use of a particular fuel so long as the fuel is broadly available, and may deny an emissions warranty claim if use of a different fuel causes the problem. EPA does not have jurisdiction over other warranties that manufacturers may provide. However, as explained above, we do not anticipate that use of E15 in MY2001 and newer light-duty motor vehicles will result in warranty claims.

b. What tests did EPA use that supports your agency's confidence that newer vehicles will be unharmed by E15? Were these tests designed specifically to test engine durability and the durability of components, such as a fuel pump and the fuel level senor? From my understanding of your testimony at the hearing, the tests simulated vehicle usage by meeting mileage thresholds, but isn't time a factor that should be considered?

A1b. Several studies provided information about the potential effects of mid-level ethanol blends on the durability of emission-related components, including engines, fuel pumps and fuel sensors. In particular, the DOE Catalyst Durability test program provided robust data for MY2001 and newer light-duty motor vehicles on the effect of long-term E15 exposure on vehicle components. The DOE program aged vehicles on E15 using the whole vehicle aging procedures defined in EPA's emission durability regulations (40 CFR 86.1823–08,1824–08). The vehicles were driven on chassis dynamometers or actual road surfaces for up to the full 120,000 mile useful life according to the standard road cycle. Since this is a whole vehicle mileage accumulation process, the entire vehicle including the engine, fuel pump, and fuel level sensor were all exposed to E15 for the full mileage accumulation period. To complete the study in a reasonable amount of time, the vehicles were driven nearly continuously over a period of six to nine months. This practice is consistent with the procedures manufacturers are required by regulation to perform in order to determine the emission deterioration of vehicles in actual use over their full useful life (FUL). Manufacturers must show that their vehicles will continue to meet emissions standards over their FUL, taking deterioration into account, to obtain the certificate of conformity that allows them to sell the vehicles.

EPA also considered the series of studies completed by the State of Minnesota and the Renewable Fuels Association (RFA),[13] including a study specifically inves-

[13] State of Minnesota and Renewable Fuels Association. The Feasibility of 20 Percent Ethanol Blends by Volume as a Motor Fuel, EPA Docket #EPA–HQ–OAR- 009–0211–0337.

tigating the effects of E20 on automotive fuel pumps.[14] In addition, EPA technical experts reviewed other relevant information such as emissions-related defects and in-use vehicle test results reported to EPA by manufacturers as required by regulation. Based on all of the information before the Agency, including our engineering analysis of the types of changes manufacturers have made in response to the increasing stringency of motor vehicle standards and the rapid rise of E10 use across the nation, EPA concluded that newer motor vehicles will be able to maintain compliance with emissions standards if operated on E15.

Q2. On July 7th, you repeatedly minimized the role of EPA is determining whether E15 gets sold in this country, citing that "[a] number of additional steps need to be taken before E15 can enter the market, and many of those steps are not under EPA's control." Without EPA granting a waiver under the Clean Air Act, could any state or individual station allow the sale of E15? Without EPA registering E15, could any state or individual station ever allow the sale of the fuel? Assuming that E85 progresses at current or slightly higher levels, is it possible to meet Renewable Fuel Standard requirements over the next eleven years with mid-level ethanol blends up to E10?

A2. The Clean Air Act prohibits fuel manufacturers from introducing E15 into commerce for use in conventional light-duty motor vehicles, but authorizes EPA to waive that prohibition if the requisite demonstration is made. Under the Clean Air Act, fuel manufacturers are also prohibited from introducing E15 into commerce for conventional vehicles until they register E15. These prohibitions do not apply to individual stations, but do apply to the fuel manufacturers that supply stations with fuel. Until a fuel manufacturer registers E15 for use in conventional vehicles, the manufacturer may sell E15 only for use in flexible-fueled vehicles.

It is possible to meet the RFS volume requirements over the next eleven years if sufficient volumes of E85 and mid-level ethanol blends are consumed or if other qualifying renewable fuels are developed and used. The actual volume of ethanol consumed will depend on the degree to which sufficient infrastructure for E85 and mid-level ethanol blends are implemented, and the extent to which other types of fuels are produced to meet the RFS volume requirements.

Q3. In response to a question from Ranking Member Miller, you referenced the Ultra Low Sulfur Diesel (ULSD) program labeling requirements and the positive experiences in avoiding misfueling with that program. There are several distinctions, though, between that labeling program and what would be required for E15: (1) EPA's labeling requirements for the high sulfur fuels was much stronger and included a noticeable "Warning" in red letters, while the final E15 label is much weaker—it is nothing more than an "Attention" label; (2) The new fuel on the market, ULSD, was compatible with both new and old vehicles and engines which is not the case for E15; (3) the end users of ULSD doing the refueling (commercial truck drivers who recently purchased the vehicle with a business interest in preserving his/her expensive truck) were likely more informed and attentive to fuel labeling than typical citizens who will be purchasing gasoline for their vehicles or off-road equipment.

In light of these distinctions, isn't the potential for misfueling a pre-model year 2001 vehicle, any heavy-duty vehicle, motorcycle or piece of non-road equipment on E15 likely to be greater than the chance of misfueling a MY2007 or newer heavy-duty truck on high-sulfur diesel fuel?

A3. No. With regard to each of the distinctions you note:

(1) EPA designed the E15 label with the help of consumer labeling experts at the Federal Trade Commission to effectively communicate key information for avoiding misfueling. As discussed in response to question 4a below, we concluded that "ATTENTION" would more appropriately alert consumers to the need to determine whether E15 is allowed for their vehicle or engine.

(2) E10 is now the predominant fuel on the market, and it is compatible with new and old vehicles and engines. There is no requirement to sell E15, and we expect that it will take some time for businesses to take the various steps needed to bring it to market and make it widely available. The E15 partial waivers and misfueling mitigation rule require that measures be taken to minimize the risk of misfueling when E15 is introduced into commerce.

(3) The ULSD program included an effective public outreach campaign, and we anticipate a similarly effective industry-led public education and outreach campaign

[14] "The Effects of E20 on Automotive Fuel Pumps and Sending Units;" Nathan Hanson, Thomas Devens, Colin Rohde, Adam Larson, Gary Mead, Paul Steevens, and Bruce Jones; Minnesota State University, Mankato; February 21, 2008. EPA Docket #EPA–HQ–OAR–2009–0211–0002.28.

for E15. Consumers have a strong interest in avoiding repair and replacement costs, whether they own trucks, cars or other vehicles and engines. EPA plans to work with E15 stakeholders to help establish a public education and outreach program that provides consumers with additional information about the potential effects of E15 on vehicles and engines.

Q4. The American National Standards Institute and the International Standardization Organization recommend very specific color, signal word, and image standards for labels. Did EPA consult these recognized authorities in creating the misfueling label?

A4. EPA communicated with the chairman of American National Standards Institute (ANSI) committee responsible for the ANSI standard for developing safety labels to obtain information about the standard as well as examples of products which had been labeled using the standard. To develop a label that would effectively convey the key information needed to avoid misfueling, we considered a broad range of public comments and expert advice, including advice from labeling experts at the Federal Trade Commission (FTC).

a. Why change the signal word from "CAUTION" to "ATTENTION" in the final label?

A4a. As discussed in the preamble of the final misfueling mitigation rule, comments in response to the proposed rule were divided between those who believed that the use of "CAUTION!" on the proposed label would deter appropriate use of E15, and those who believed that it would not be effective at preventing misfueling. We discussed this issue with FTC's consumer labeling experts who advised that "ATTENTION" would more likely attract consumer notice without the risk of discouraging appropriate use of the fuel. EPA concluded that "ATTENTION" strikes the right balance between alerting consumers about the improper use of E15 and scaring them away from appropriate use of E15. FTC staff also suggested that "ATTENTION" be placed at an angle in the upper left corner of the label to help draw consumers' eyes to it, and we adopted that placement.

b. Why did EPA not include a picture of the types of vehicles and products that can or cannot use E15?

A4b. As discussed in the preamble of the final misfueling mitigation rule, EPA decided not to require icons for several reasons. First, the icons suggested by some public commenters for on-highway vehicles that can, or cannot use, E15 relied on text to convey much of their message. Those icons also depicted a passenger car, which is only one of several vehicle types that can use E15 if from the specified model years. The other suggested icons portrayed only some of the nonroad vehicles and equipment that cannot use E15, which could have led consumers to incorrectly infer that E15 can be used in the types of equipment not depicted. In addition, use of multiple icons would have made the label more dense and complicated. Labeling experts at the FTC advised that consumers are unlikely to read lengthy pump labels with many icons. However, to the extent a fuel provider believes icons would be helpful to its customers, it may post them on its own signs and/or develop and submit an alternative E15 label including appropriate icons for EPA consideration and approval.

Questions submitted by the Honorable Chuck Fleischmann

Q1. Please provide a breakdown of the total amount of funds expended by the EPA in setting fuel economy standards/mobile source greenhouse gases since 2007 by year.

A1. The following amounts have been allocated since 2007 for work supporting the development and implementation of GHG emissions standards for mobile sources: 2007: $6.7 million; 2008: $4.3 million; 2009: $3.1 million; 2010: $3.2 million; and in 2011: $6.8 million. For FY 2012, the total amount of funds requested in the President's Budget proposal is $9.2 million.

Q2. What has been the total cost of EPA regulations on the auto industry from January 20, 2009 to the present?

A2. The light-duty GHG standards begin implementation in 2012, while the Heavy-duty GHG standards begin implementation in 2014. Therefore, there have been virtually no costs associated with these regulatory programs for the time period highlighted in this question.

Q3. When does the EPA contemplate proposing fuel economy standards for heavy duty trucks for Model Year 2019 and later?

A3. EPA and DOT have not set a schedule for the next set of GHG and fuel efficiency standards for heavy-duty trucks and vehicles.

Q4. How many EPA employees are working on regulating fuel economy/mobile source greenhouse gases? The agency utilized base staffing levels for these standards, and to develop the 2017- 2025 vehicle standards, but we do not have a separate budget line-item for this effort.

A4. EPA hired an additional 8 FTE in 2011 to support the 2012–2016 vehicle and the 2014–2018 truck standards. These were the only new FTE to support mobile source GHG standards.

5. Last year, the EPA finalized a fuel economy/mobile source greenhouse gas rule for model years 2012 to 2016 that will raise the average price of a new vehicle by approximately $950. Last month, it was reported that the EPA is considering raising the fuel economy standard gain to 56.2 mpg for model years 2017 to 2025. By the EPA's own estimates, raising the fuel economy standard to 56.2mpg will increase the price of a new vehicle by between $2,100 and $2,600. These two rulemakings will increase the average price of a new vehicle in 2025 between $3,050 and $3,550. Accordingly, how many Americans will be priced out of the new car market in 2025 if, on average, $3,000 is added to price of a new vehicle?

A5. The Agencies will provide an assessment of the cost of the 2017–2025 proposed fuel economy and greenhouse gas standards as part of the agencies' joint rulemaking proposal in the fall of 2011. There will be two primary economic impacts of more stringent future fuel economy and greenhouse gas emissions standards on new car buyers: a higher up-front price and ongoing fuel savings. For example, for the 2012–2016 standards, while the up-front cost is about $950 higher, fuel savings are estimated at about $4,000 over the life of the vehicle. While EPA and NHTSA are still completing our analysis of projected vehicle price increases for the MY2017–2025 proposed standards, we are confident that both the lifetime and 5-year consumer fuel savings, discounted to account for net present value, will exceed the projected vehicle price increases. It is also likely that consumers who buy a vehicle with a 5-year loan will benefit from positive cash flow immediately upon purchase as the monthly fuel savings exceed the incremental monthly loan payment.

Questions submitted by the Honorable Randy Neugebauer

Q1. Ms. Oge, could you explain the details behind what makes an engine in a vehicle from model years 2001 and later safe to use E15 while that fuel is not suitable for a vehicle from a model year of 2000 or earlier? What is the mechanical and physical difference between an engine from 2000 versus an engine from 2001 related to the use of E15, and why did the EPA determine that one is safe for E15 and one is not?

A1. In the E15 partial waiver decisions, EPA allowed E15 for sale only for the vehicles that extensive testing and analysis show can meet emission standards on E15. We denied the waiver for all other vehicles and engines because there was insufficient information to allay engineering concerns that E15 could cause or contribute to these products exceeding the emissions standards to which they were certified. EPA did not determine there are any mechanical or physical differences between the engines used in MY2000 and older vehicles versus the engines used in MY2001 and newer vehicles that caused us to deny the waiver for the former population of vehicles. Rather, available information and analysis indicated that the emission control systems of MY2001 and newer light-duty motor vehicles could maintain compliance with emissions standards when the vehicles were operated on E15. EPA's analysis is described in detail in sections IV. A of the January 2011 decision document and IV. C of the November 2010 decision document.

Q2. Could you please briefly explain the damage that would occur to an engine in the case of using E15 in an engine not approved for such usage?

A2. It is not possible to predict exactly what type of damage, if any, would occur to a particular engine in view of the vast array of engines which may not use E15. We denied a waiver for the sale of E15 for use in these engines because there was insufficient information to allay engineering concerns that E15 could cause or contribute to the engines exceeding the emissions standards to which they were certified. Those concerns include potential adverse effects on catalyst durability, fuel systems, evaporative emissions control systems and internal engine components. Please see the Nov. 4, 2010 waiver decision (75 Fed. Reg. 68094) and misfueling mitigation proposed rule (75 Fed. Reg. 68044) for detailed discussions of the potential impacts of E15 exposure on the emission control-related components of vehicles and engines for which a waiver for E15 was denied.

DOE-sponsored testing has provided data on possible damage to non-road engines. A 2009 report by DOE found that two studies on the effect of E15 on nonroad engines were inconclusive but indicated potential problems in small non-road engines, including higher engine and exhaust temperatures and, in the case of three handheld trimmers, higher idle speeds and unintentional clutch engagement. A recently issued DOE report on the effects of E15 on current and legacy marine engines showed that of the three outboard engines tested, two had mechanical failures and the third exhibited misfire/rough operation at the end of the test period.

Q3. Has the EPA estimated the frequency that consumers are expected to mis-fuel their vehicles with E15 and the economic damage that would cause? Does the EPA believe that a simple pump label is sufficient to prevent consumers from putting the wrong fuel in their vehicle?

A3. There is very little test data with respect to the effect of E15 use in MY2000 and older light-duty motor vehicles and all heavy-duty gasoline engines and vehicles, motorcycles, and nonroad products. Our engineering assessment for these vehicles, engines, and products indicates a number of emission-related concerns with the use of E15. However, without more data, it is not possible to precisely quantify the frequency at which these vehicles, engines, and products might experience problems if fueled with E15.

To minimize potential misfueling, EPA conditioned the E15 partial waivers on effective misfueling mitigation measures being taken. The Agency also issued a final rule establishing four regulatory provisions to further address concerns about potential misfueling: (1) a prohibition against the use of gasoline containing more than 10 vol% ethanol in vehicles, engines and equipment not covered by the partial waiver decisions, specifically MY2000 and older motor vehicles, heavy-duty gasoline engines and vehicles, on and off-highway motorcycles, and nonroad engines, vehicles, and equipment; (2) labeling requirements for fuel pumps that dispense E15 to alert consumers to the appropriate and lawful use of the fuel; (3) the addition to product transfer documents of information regarding the ethanol content of, or the level of ethanol that may be added to, gasoline being sold to retail stations or wholesale purchaser-consumers so that E15 may be properly blended and labeled; and (4) an ongoing implementation survey requirement to ensure that E15 is in fact being properly blended and labeled (76 FR 44406, Jul. 25, 2011). In addition, EPA plans to work with stakeholders to develop an industry-led public education and outreach campaign; monitor the effectiveness of misfueling mitigation measures as E15 enters in the market; and take any further actions as needed and appropriate.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mr. Bob Greco, Group Director, Downstream and Industry Operations, American Petroleum Institute

Questions submitted by Chairman Andy Harris

Q1. During the question-and-answer session, Ms. Oge indicated that the CRC research was not properly designed. Please identify who designed the CRC testing and explain the difference or differences between the testing which EPA relied on for making a decision on the E15 waiver and the testing that the automotive and oil industries are conducting through CRC?

A1. The E10+ research program currently being conducted by the CRC was designed by technical committees comprised of Automakers (Chrysler, Ford, GM, Honda, Mitsubishi, Nissan, Toyota, VW), Petroleum Companies (BP, Chevron, ConocoPhillips, ExxonMobil, Marathon, Shell). In addition, DOE (through the National Renewable Energy Lab) assisted in the design of two of the CRC E10+ studies: (a) engine durability and (b) the durability of automotive fuel system components exposed to E20. In fact, DOE also provided some financial support for the latter.

The key difference between the CRC test program and the DOE study, which EPA relied upon for the E15 waiver, is the scope of the two efforts. The DOE study was designed for and targeted at determining effects of mid-level ethanol blends on the catalytic converters used in vehicle exhaust emission control systems, whereas the CRC program included tests which address the full range of potential short- and long-term emissions and performance issues associated with operating highway vehicles on these fuels. The CRC program is therefore a significantly more robust and comprehensive effort than that undertaken by DOE. As described in my written statement, the CRC program includes studies which evaluate: (a) engine durability, (b) vehicle fuel storage and handling equipment durability, (c) onboard diagnostic systems, (d) long term evaporative emissions control systems durability, and (e) emissions inventory/air quality modeling of mid-level ethanol blends. Attachment 1 to my written statement presents the timeline for this ongoing CRC effort.

Q2. In June of 2008, EPA staff presented "Staff Recommendations" for a mid-level ethanol blends test program to support a waiver during a meeting of API's Technical Committee in Chicago. How did this framework differ from the test program that EPA relied on in their decision?

A2. The "Staff Recommendations" made by EPA in June of 2008 outlined a framework for a comprehensive mid-level ethanol test program that included tests designed to address exhaust emissions, evaporative emissions, as well as materials compatibility and driveability or operability issues for both highway and non-road vehicles. For the waiver decisions, EPA effectively ignored this approach. It relied heavily on the results of the DOE Catalyst study which focused exclusively on an evaluation of long-term exhaust emissions control systems durability issues associated with the use of mid-level ethanol blends in highway vehicles. The Agency also inappropriately relied on the DOE study to draw conclusions about evaporative and engine system durability impacts for which the program was not designed to address.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Ms. Heather White, Chief of Staff and General Counsel, Environmental Working Group

Questions submitted by Chairman Andy Harris

Q1. In light of your testimony about the human health effects of E15, would you support EPA requiring applicants to conduct additional testing on physiological and health impacts before registering the fuel?

A1. Yes. Environmental Working Group would support efforts by the Environmental Protection Agency to require applicants to conduct additional testing on environmental and human health impacts before registering E15, pursuant to section 211(o) of the Clean Air Act, 42 U.S.C.§7545. As I mentioned in my oral testimony, we believe in a strong, vibrant, well-funded EPA and most of the time, we agree with EPA regulators. The E15 decision, however, concerns us because of the potential environmental and health impacts of its use. The agency should require additional testing of E15 before this fuel goes on the market, given that E15 has substantially different properties than gasoline blended with 10 percent ethanol (E10). EPA should specifically analyze the health impacts of E15 and associated air pollution on children, pregnant women, minority or low-income communities, and other sensitive populations. EPA should also consider E15's direct and indirect impacts on fuel mileage, underground storage tanks and other fueling or storage infrastructure, air quality, and water resources. All testing results and EPA analyses should also be made available to the public upon completion.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mr. Jeff Wasil, Emissions Certification Engineer, Evinrude Outboard Motors

Questions submitted by Chairman Andy Harris

Q1. The U.S. Coast Guard filed comments in opposition to the granting of an E15 waiver. Rear Admiral Kevin Cook cited a "reduction in the level of safety for recreational boaters" and fuel system deterioration as reasons not to grant the waiver. Do you agree with this assessment of the potential safety hazards cited by the U.S. Coast Guard?

A1. Yes, I agree with the U.S. Coast Guard's assessment. While there have been boat fuel system issues associated with E10, increasing the ethanol content by fifty percent to E15 will merely exacerbate these safety concerns. As I stated in my written testimony, we have evidence that an E15 blend of gasoline is almost certain to damage marine and other engines. Testing of E15 done by the Department of Energy's National Renewable Energy Laboratory focusing specifically on marine engines has demonstrated significant damage to most of the engines tested, with those that were not damaged demonstrating problems with performance, including the ability to run smoothly and start promptly. If such problems occur in an automobile, it's very simple: you wait for the tow truck to arrive. You're usually not in any danger, and it's just an inconvenience. If your engine breaks down while you are twenty miles at sea, however, it's an entirely different matter. You could be drifting helplessly, caught in a storm, and in grave danger-all because your fuel was an E15 blend. You might have to be rescued by the Coast Guard, thereby putting their boat and crew in danger. The irony is that this is a potential disaster that is easy to avoid: we simply do not move to a standard E15 fuel. There might be those who would suggest that you simply fuel your boat with no-ethanol gasoline or low-ethanol gasoline, and that would be ideal. But if E15 becomes the standard fuel, you might not have that option. There is no need for the headlong rush to E15 being pursued by the EPA. The Coast Guard got it right. Such a move would reduce the level of safety for recreational boaters, and it should not be done.

Q2. You stated in your testimony that the EPA label for gasoline pumps that will dispense E15 is inadequate. Can you describe your specific concerns with EPA's misfueling label?

A2. The misfueling label proposed by the EPA is inadequate. EPA asked for comments on its proposed label, and then it proceeded to ignore comments from some States, environmental groups, and marine, vehicle, engine, and petroleum industries, all of whom indicated that the label needed to be strengthened. As demonstrated from our past experience when the country transitioned from leaded to unleaded gasoline, a label alone is inadequate as a way of preventing misfueling. Our experience when unleaded fuel was introduced is that misfueling with leaded fuel was widespread, even with different nozzle sizes that were supposed to prevent such. Labels alone do not work, because the burden for preventing misfueling and subsequent engine damage or threats to operator safety is dependent on the consumer's first noticing and reading the label among all the others that are affixed to a gasoline pump and then making a decision about whether or not the label applies to his or her engine before deciding to dispense the fuel. The label proposed by the EPA is only in English and does not contain any graphic representations or pictures to supplement the text. This English-only text will increase the likelihood of misfueling, as the EPA apparently assumes that everyone in this country can read and understand English, which is most definitely not the case. Even assuming that the consumer actually notices the label on the fuel dispenser and can read the text, the language is not strong enough to warrant any real concern. The use of the word "Attention" on the EPA label is simply not strong enough to warn the consumer of potential ramifications of the misuse of this product. In a product safety sense and degree of risk assessment, the word "Attention" typically means, "The user should observe this information to ensure the proper use of the product, although failure to do so may not result in injury." The word "Caution" would be better suited, meaning, "Failure to observe this instruction may result in injury or property damage." Additionally, the label should direct readers to consult their equipment owner's manual. Finally, regular misfueling surveys should be conducted to determine whether the label is working as designed and is actually preventing misfueling. If the label proves to be ineffective, E15 should be withdrawn from the marketplace until more effective misfueling prevention measures are implemented.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Ron Sahu, Technical Consultant, Outdoor Power Equipment Institute

Questions submitted by Chairman Andy Harris

Q1. You included with your testimony a critique of a DOE report on the effects of ethanol blends on legacy vehicles and small non-road engines.
Q1a. Could you summarize what you found in anallyzing DOE's testing?

A1a. I reviewed the DoE Report entitled "Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1—Updated," NREL/TP-540-43543 and ORNL/TM-2008/117, dated February 2009.

First, I found that the testing plan and scope was inadequate to provide a reasonably complete picture of the effects of greater than E15 ethanol on the target engine and equipment universe—basically the number and types of tests conducted was inadequate and therefore the results, even if they had indicated little or no impacts, would have been suspect. Certainly there were not enough tests conducted to deduce and statistical relationships.

Second, the above notwithstanding, based on my review, I found that the report did note the following major adverse impacts due to use of fuels with ethanol content greater than 10%:

(a) engine exhaust temperatures rose significantly—yet the report did not discuss any of the implications of these higher temperatures and additional heat including impacts on the engine and equipment (including catalysts if present) itself, personnel safety, increased fire hazards, or the inability to mitigate any of these hazards;

(b) risks to operators dramatically increased such as due to unintentional clutch engagement which resulted on several tested products such as chainsaws because of high idle speeds;

(c) Damage to Engines to the extent that some suffered total and complete failures and would not start or operate after running on E15 fuel; and

(d) Operational Problems on many of the engines tested on mid-level ethanol such as erratic equipment operation, "missing" and stalling of engines, and power reduction.

Third, somewhat troublingly, I also found that Executive Summary of the report did not accurately summarize the scope, results as well as uncertainties associated with the testing which were reported in the main body of the report itself. It is my opinion that since most of the policy-makers will focus only on the Executive Summary, this could result in misinformed policies based on misleading conclusions.

Q1b. If you were to extend a similar assessment to the DOE Catalyst Study for on-road vehicles that EPA relied upon in granting a partial waiver, would you have similar criticism? Would you have designed the test program differently?

A1b. Based on my experience with reviewing the prior report, I would have concerns regarding test design and scope since this is fundamental to the conclusions that are being drawn from the findings. I will give one example.

The test procedure on which EPA relied is known as the "Standard Road Cycle" (SRC) (Federal Register /Vol. 75, No. 213 /Thursday, November 4, p68107). This procedure is only applicable to MY2008 and newer on-road vehicles. This procedure was finalized in January 2006 (Federal Register / Vol. 71, No. 10 / Tuesday, January 17, 2006 / pp 2810–2842) and was developed in response to a court finding that EPA's CAP 2000 regulations did not satisfy the requirements of section 206(d) of the CAA (Ethyl Corp. v. EPA). Manufacturers typically apply for vehicle emissions certification the year before a model goes on sale to allow time for the certification data to be reviewed and the certification issued. This means that a MY 2008 vehicle would have its data submitted in 2006. EPA recognized this by having the rule containing the SRC go into effect for the 2008 model year; further, EPA did not make any changes to the carryover provisions in the current regulations (ref. 40 CFR 86.1839–01). These provisions allow manufacturers to use durability data that was previously generated and used to support certification provided that the data "represent a worst case or equivalent rate of deterioration".

Based on the above, it is likely that very few of the vehicles tested in the DoE catalyst durability program were certified using the SRC durability program.

It is my understanding that as the test program was originally envisioned, the 2001 Hyundai Accent that failed analogous testing in Australia was to be one of the first vehicles tested. The purpose was to determine whether the test cycle itself was adequate since there is no data demonstrating that the EPA SRC cycle is sufficient

to detect a vehicle whose catalyst would be damaged by the use of fuel containing ethanol in excess of that for which it was designed. Had the Hyundai Accent failed then this would have confirmed that the SRC could detect a failing vehicle; conversely, had it passed then it might have been concluded that the test cycle was inappropriate for this purpose.

Yet, in the EPA/DOE test program, the Hyundai Accent was removed from the list of vehicles—thus it is unclear whether the SRC is an appropriate cycle or not.

Thus one change to the test design would have been to include the Hyundai Accent in the program and to have first tested it, confirming the usefulness (hopefully) of the SRC and then to have used the SRC in subsequent tests.

Appendix II

Additional Material for the Record

ADDITIONAL MATERIAL FOR THE RECORD

Material Submitted by Representative Brad Miller

RFA RENEWABLE FUELS ASSOCIATION

30 Years of Leadership

July 6, 2011

The Honorable Andy Harris
Chairman
Subcommittee on Energy and Environment
Committee on Science, Space and Technology
U.S. House of Representatives

The Honorable Brad Miller
Ranking Member
Subcommittee on Energy and Environment
Committee on Science, Space and Technology
U.S. House of Representatives

Dear Chairman Harris and Ranking Member Miller:

The Renewable Fuels Association (RFA) is the national trade association representing the U.S. ethanol industry. The Subcommittee's hearing on the science of E15 is a timely and important hearing. As no representative from the ethanol industry was invited to testify, we wanted to be sure the Subcommittee was provided the perspective of American ethanol producers and marketers.

As all Americans are well aware, gasoline prices remain high and consumers are seeing higher oil prices drive up the cost of everything from food to clothing. Our nation's ethanol industry is already helping to decrease our reliance on foreign oil and keep volatile gasoline prices in check. As a recent university study concluded, ethanol helped keep 2010 gas prices $0.89 lower than they otherwise would have been. The industry is poised to make even more significant contributions to our domestic transportation fuel supply in the future if regulatory constraints to the use of ethanol fuels are removed.

Full implementation of the Energy Independence and Security Act of 2007 (EISA) will require the use of ethanol beyond the traditional 10 percent blends, as 36 billion gallons of renewable fuels represents about 25 percent of the gasoline pool. Unfortunately, current regulations limit the amount of ethanol that can be blended with gasoline to 10 percent for conventional automobiles. The U.S. Environmental Protection Agency (EPA) has approved E15 blends to for use in cars, pickups and SUVs built in 2001 and later, or about two-thirds of the vehicles on the road today.

We believe EPA's decision is sound, based upon the most robust test program ever conducted by the federal government for a CAA Section 211(f) fuel waiver, and finalized only after a lengthy public rulemaking process in which the auto industry provided no data demonstrating a single emissions, materials compatibility or driveability problem associated with the use of E15.

Recently, Representative James Sensenbrenner, Vice Chairman of the House Science, Space and Technology Committee, asked automakers whether they were "confident" their cars and trucks "will not be damaged" by the use of E15. Frankly, in asking auto companies to prove a negative, the Vice Chairman was asking the wrong question. Indeed, most responses simply acknowledged they did not know because they do not believe adequate testing has been done. That does not mean E15 is not safe for their vehicles; it simply means they want to have more data. But the auto/oil industry test program they await has been years already in the offing and has been marred by delays and questionable test protocols.

Again, we believe the EPA test program, conducted by the U.S. Department of Energy (DOE) using EPA protocols provides a very robust database to answer the fundamental question – can E15 be used safely in motor vehicles and maintain emissions performance? The answer to that question is a resounding – yes.

In fact, the RFA continues to urge EPA to extend the waiver for E15 use to all conventional light-duty vehicles. A report by the highly regarded automotive engineering firm, Ricardo Inc., concluded there were no unique emissions, material compatibility or drivability issues with older vehicles compared to 2001 automobiles. (A copy of the Ricardo report is attached.) This analysis together with affirmative results in reports from the DOE and other academic and private testing institutions show that there are no significant issues with the use of E15 in virtually all vehicles on the road today. Our nation can and should move in the direction of ethanol blends in excess of 10 percent in conventional, gas-only vehicles.

As with any new fuel, additional testing and some regulatory issues relating to the fuel's properties must be addressed before widespread E15 use can occur. The RFA is working with the EPA and others to address those issues and accelerate the commercial use of E15. The concerns expressed by automakers and gasoline retailers are not insurmountable. If we can successfully put a man on the moon, we can safely increase ethanol content in gasoline by just five percent.

It will be critical to the future growth opportunities for cellulosic and advanced ethanol to promote ethanol's important role as an alternative fuel as well. Currently, the E85 market represents just a fraction of the overall U.S. ethanol market, but it is growing. We estimate that there are about 8.5 million flexible fuel vehicles (FFV) on America's roadways today. That is up significantly from recent years and a testament to the leadership and commitment of General Motors and Ford; but it still represents just 3 percent of the total automotive fleet. Likewise, we estimate E85 and mid-level blends are offered at approximately 2,700 retail gas stations across the U.S. That is a huge improvement over the handful of E85 stations just a decade ago, but it still represents just 1.5 percent of the nation's gas stations.

Obviously, we have a long way to go if consumers are to be given the flexibility to maximize their use of domestic renewable fuels like ethanol. Efforts to expand FFV technology must be a part of our energy future. Putting more Americans behind the wheel of an FFV is a critical component of our strategy to transform current ethanol policy and the current ethanol industry. Together with more blender pumps, investment in infrastructure is one leg of the approach that recognizes the need to put the market back in ethanol policy.

Overcoming this "blend wall" issue is paramount to the success of the RFS. Cellulosic and advanced ethanol will largely represent the renewable fuel supply beyond the E10 blend market. To leave the market artificially constrained further limits market opportunities for next generation biofuels very close to commercialization, missing an opportunity to meaningfully increase America's use of

renewable fuels and reduce our dependence on imported oil. The RFA looks forward to working with you to further develop and implement sound policies around the science of E15.

Sincerely,

Bob Dinneen
President & CEO

Material Submitted by Chairman Andy Harris

http://edocket.access.gpo.gov/2010/pdf/2010-27432.pdf

ENVIRONMENTAL PROTECTION AGENCY [EPA-HQ-OAR-2009-0211; FRL-9215-5] Partial Grant and Partial Denial of Clean Air Act Waiver Application Submitted by Growth Energy To Increase the Allowable Ethanol Content of Gasoline to 15 Percent; Decision of the Administrator

AGENCY: Environmental Protection Agency.

ACTION: Notice of partial waiver decision.

SUMMARY: The Environmental Protection Agency (EPA) is partially granting Growth Energy's waiver request application submitted under section 211(f)(4) of the Clean Air Act. This partial waiver allows fuel and fuel additive manufacturers to introduce into commerce gasoline that contains greater than 10 volume percent ethanol and no more than 15 volume percent ethanol (E15) for use in certain motor vehicles if certain conditions are fulfilled. We are partially approving the waiver for and allowing the introduction into commerce of E15 for use only in model year 2007 and newer light-duty motor vehicles, which includes passenger cars, light-duty trucks and medium-duty passenger vehicles. We are denying the waiver for introduction of E15 for use in model year 2000 and older light-duty motor vehicles, as well as all heavy-duty gasoline engines and vehicles, highway and off-highway motorcycles, and nonroad engines, vehicles, and equipment. The Agency is deferring a decision on the applicability of a waiver to model year 2001 through 2006 lightduty motor vehicles until additional test data, currently under development, is available.

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA-HQ-OAR-2009-0211. All documents and public comments in the docket are listed on the http://www.regulations.gov Web site. Publicly available docket materials are available either electronically through http://www.regulations.gov or in hard copy at the Air and Radiation Docket in the EPA Headquarters Library, EPA West Building, Room 3334, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding holidays. The telephone number for the Reading Room is (202) 566-1744. The Air and Radiation Docket and Information Center's Web site is http://www.epa.gov/oar/ docket.html. The electronic mail (email) address for the Air and Radiation Docket is: a-and-r-Docket@epa.gov, the telephone number is (202) 566-1742 and the fax number is (202) 566-9744. FOR FURTHER INFORMATION CONTACT: Robert Anderson, Office of Transportation and Air Quality, Mailcode: 6405J, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; telephone number: (202) 343-9718; fax number: (202) 343-2800; e-mail address: Anderson.Robert@epa.gov.

http://edocket.access.gpo.gov/2011/pdf/2011-1646.pdf

ENVIRONMENTAL PROTECTION AGENCY [EPA-HQ-OAR-2009-0211; FRL-9258-6] Partial Grant of Clean Air Act Waiver Application Submitted by Growth Energy To Increase the Allowable Ethanol Content of Gasoline to 15 Percent; Decision of the Administrator

AGENCY: Environmental Protection Agency.

ACTION: Notice of Decision Granting a Partial Waiver.

SUMMARY: The Environmental Protection Agency (EPA) is taking additional final action on Growth Energy's application for a waiver submitted under section 211(f)(4) of the Clean Air Act. Today's partial waiver allows fuel and fuel additive manufacturers to introduce into commerce gasoline that contains greater than 10 volume percent ethanol and no more than 15 volume percent ethanol (E15) for use in model year (MY) 2001 through 2006 light-duty motor vehicles (passenger cars, light-duty trucks and medium-duty passenger vehicles), if certain conditions are fulfilled. In October 2010, we granted a partial waiver for E15 for use in MY2007 and newer light-duty motor vehicles subject to the same conditions. Taken together, the two waiver decisions allow the introduction into commerce of E15 for use in MY2001 and newer light-duty motor vehicles if those conditions are met.

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA-HQ-OAR-2009-0211. All documents and public comments in the docket are listed on the http:// www.regulations.gov Web site. Publicly available docket materials are available either electronically through http://www.regulations.gov or in hard copy at the Air and Radiation Docket in the EPA Headquarters Library, EPA West Building, Room 3334, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding holidays. The telephone number for the Reading Room is (202) 566-1744. The Air and Radiation Docket and Information Center's Web site is http://www.epa.gov/oar/ docket.html. The electronic mail (email) address for the Air and Radiation Docket is: a-and-r-Docket@epa.gov, the telephone number is (202) 566-1742 and the fax number is (202) 566-9744. FOR FURTHER INFORMATION CONTACT: Robert Anderson, Office of Transportation and Air Quality, Mailcode: 6405J, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; telephone number: (202) 343-9718; fax number: (202) 343-2800; e-mail address: Anderson.Robert@epa.gov.

March 26, 2009

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
Washington, D.C. 20585-1000

The Honorable Lisa Jackson
Administrator
U.S. Environmental Protection Agency
Washington, D.C. 20460

The Honorable Tom Vilsack
Secretary of Agriculture
U.S. Department of Agriculture
Washington, D.C. 20250

The Honorable Carol Browner
Asst. to the President for Energy & Climate Change
The White House
Washington, D.C. 20500

Dear Secretaries Chu and Vilsack, Administrator Jackson and Mrs. Browner:

The undersigned diverse group of business, environmental, taxpayer, free-market and public health groups opposes any administrative or legislative efforts to increase the current cap on the amount of ethanol permitted to be blended into gasoline until independent and comprehensive testing has been completed that indicates that such mid-level ethanol blends (whether E12, E15 or E20) will not pose a risk to all gasoline-powered engines, to public health, to the environment and to consumers.

To quote from President Obama's March 9, 2009 Memorandum on "Scientific Integrity":

> "Science and the scientific process must inform and guide decisions of my Administration on a wide range of issues, including improvement of public health, protection of the environment, increased efficiency in the use of energy and other resources, mitigation of the threat of climate change, and protection of national security."

Some have advocated that Congress or the Environmental Protection Agency ignore President Obama's Memorandum, avoid the safeguards built into Section 211(f) of the Clean Air Act (safeguards that were just strengthened by Congress in 2007), and approve mid-level ethanol blends before comprehensive testing programs on these blends have been completed by qualified and independent stakeholders, such as the Department of Energy and the Coordinating Research Council. We collectively, and strongly, oppose such an ill-considered approach as contrary to scientific integrity and potentially harmful to our environment, public health and consumers.

Sincerely,

Alliance for Worker Freedom
American Bakers Association
American Beverage Association
American Conservative Union
American Lung Association

American Meat Institute
American Sportfishing Association
Americans for Tax Reform
Americans for the Preservation of Liberty
Association of International Automobile Manufacturers
Association of Marina Industries
Boat Owners Association of the United States
Center for Auto Safety
Clean Air Task Force
Competitive Enterprise Institute
Council for Citizens Against Government Waste
Earthjustice
Engine Manufacturers Association
Environmental Working Group
Friends of the Earth
Grocery Manufacturers Association
Hispanic Alliance for Prosperity Institute
The Hispanic Institute
International Dairy Foods Association
International Snowmobile Manufacturers Association
National Center for Public Policy Research
National Chicken Council
National Council of Chain Restaurants
National Marine Manufacturers Association
National Petrochemical and Refiners Association
National Restaurant Association
National Taxpayers Union
National Turkey Federation
Natural Resources Defense Council
Outdoor Power Equipment Institute
Personal Watercraft Industry Association
Public Citizen
Sierra Club
Small Business & Entrepreneurship Council
Snack Food Association
Taxpayers for Common Sense

Alabama Poultry and Egg Association
California Poultry Federation
Georgia Poultry Federation

Indiana Poultry Federation
Iowa Turkey Federation
Minnesota Turkey Growers Assocation
Mississippi Poultry Association
North Carolina Poultry Federation
Poultry Federation of Arkansas, Oklahoma and Missouri
Virginia Poultry Association

Butterball, LLC
FarmEcon LLC.
Gold'n Plump Poultry
Pilgrim's Pride

cc: The Honorable Nancy Pelosi
The Honorable Steny Hoyer
The Honorable Henry Waxman
The Honorable Harry Reid
The Honorable Richard Durbin
The Honorable Barbara Boxer
The Honorable John Boehner
The Honorable Eric Cantor
The Honorable Joe Barton
The Honorable Mitch McConnell
The Honorable Jon Kyl
The Honorable James Inhofe

AMERICAN MOTORCYCLIST ASSOCIATION
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AmericanMotorcyclist.com

July 6, 2011

The Honorable Andy Harris, M.D.
Chairman
Subcommittee on Energy and Environment
U.S. House of Representatives
Washington, DC 20515

The Honorable Brad Miller
Ranking Member
Subcommittee on Energy and Environment
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Harris and Ranking Member Miller:

The American Motorcyclist Association (AMA) and its partner organization, the All-Terrain Vehicle Association (ATVA), applaud the Energy and Environment Subcommittee of the House Science, Space and Technology Committee for holding a hearing entitled "Hitting the Ethanol Blend Wall: Examining the Science on E15" on July 7th. Our Associations have concerns with the new ethanol blend for the following reasons: 1) availability of appropriate motor fuels; 2) effect of ethanol on unapproved vehicles; 3) hygroscopic nature of ethanol; and 4) blender pumps. The Subcommittee needs to urge for additional scientific studies to determine the long-term feasibility of mandating increased levels of ethanol in gasoline.

Founded in 1924, the AMA is the premier advocate of the motorcycling community, representing the interests of millions of on- and off-highway motorcyclists. Our mission is to promote the motorcycle lifestyle and protect the future of motorcycling.

In October 2010, the U.S. Environmental Protection Agency (EPA) approved E15, a new gasoline formulation that contains up to 15 percent alcohol by volume, for use in model year 2007 and newer light duty vehicles (cars, light-duty trucks, and medium-duty passenger vehicles). In January 2011, it added model year 2001-2006 light duty vehicles to the approved list.

The AMA and ATVA are concerned about E15 because no on- or off-highway motorcycles or all - terrain vehicles (ATVs) are currently approved and should not be approved to use this new intermediate ethanol blended motor fuel.

The continued availability of appropriate motor fuels is of great concern to our members and the riding community. The petroleum industry and the U.S. EPA should assure all consumers that they will not ignore the fuel requirements of existing vehicles and engines in the quest for increased ethanol use in gasoline.

Introduction of E15 into unapproved vehicles and engines may lead to costly damage to gasoline-powered consumer vehicles and products, potential voiding of manufacturers' warranties on these products, and is a violation of federal law.

Specifically, the EPA approved E15 combusts at a higher temperature than gasoline with a lesser amount of ethanol. In engines not designed to dissipate this additional heat, engine damage in the form of premature wear can result. This is a concern for all motorcycles and ATVs, and particularly for the air-cooled engines found in many machines.

Furthermore, motorcycle and ATV owners, dealers, and service facilities are reporting increased numbers of fuel-related problems, including leaks, hard starting, rough idling, less than optimal performance, and long-term storage issues.

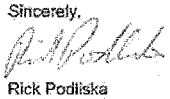
The hygroscopic nature of ethanol causes the introduction of more water into the fuel system of vehicles and engines fueled by ethanol-blended gasoline than would occur with straight gasoline (E0). Relative to water in gasoline, some vehicles and engines experience little or no problems with small volumes in their fuel; however, small displacement engines are often sensitive to any quantity of water in their fuel systems.

Retail outlet blender pumps, which dispense multiple grades of gasoline through a single hose, further complicate matters for motorcycle and ATV owners. While dispensing large quantities of fuel, any E15 remaining in a blender pump system and hose would be quickly mixed with another blend such as E10 or E0. However, fuel tanks and approved portable storage containers with capacities of just a few gallons would ultimately contain more ethanol than the fuel product selected on the gas pump's dial. Therefore, a consumer may be introducing a blend of ethanol greater than 10 percent by volume into their vehicle or engine, even though they selected and paid for a lower blend, such as E10 or even E0.

In conclusion, the AMA and ATVA urge the Subcommittee to call for additional scientific studies to determine the long-term feasibility of mandating increased levels of ethanol in gasoline. Not only should the studies focus on the short- and long-term impacts on vehicles and engines, but should consider financial implications of increased ethanol use in gasoline on consumers; fuel producers, distributors, and retailers; vehicle and engine manufacturers, dealers and service facilities; and the environment.

Again, thank you for holding this hearing on "Hitting the Ethanol Blend Wall: Examining the Science on E15," and for the opportunity to express our concerns to the Subcommittee on behalf of our members and the motorcycle and ATV riding communities.

Sincerely,



Rick Podliska
Washington Representative

CC: The Members of the U.S. House Subcommittee on Energy and Environment

Material Submitted by Representative F. James Sensenbrenner

F. JAMES SENSENBRENNER, JR.
FIFTH DISTRICT, WISCONSIN

COMMITTEE ON THE JUDICIARY

SUBCOMMITTEE ON
CRIME, TERRORISM, AND
HOMELAND SECURITY
CHAIRMAN

COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY
VICE-CHAIRMAN

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HTTP://SENSENBRENNER.HOUSE.GOV

July 5, 2011

The Honorable Lisa Jackson
Administrator
The Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20004

Dear Administrator Jackson,

The Environmental Protection Agency (EPA) is increasingly out of touch with American consumers. Rebuilding our economy doesn't require that we sacrifice our environmental ideals, but the costs of agency actions must be balanced against the environmental benefits. Increasingly, the EPA seems focused on regulatory action with crippling costs and, at best, minimal environmental benefits.

The EPA recently issued a waiver to allow gasoline blends of up to 15% ethanol (E15) in cars and trucks of model year 2001 and later. This decision was apparently based on narrow Department of Energy testing that did not consider the effect that E15 would actually have on car engines.

On June 1, 2011, I wrote to 14 auto manufacturers and asked 3 questions: (1) Will E15 damage engines of model year 2001 and later? (2) Will your warranties cover damage from E15? and (3) Will E15 negatively affect fuel efficiency?

Engine manufacturers have been nearly unanimous in their beliefs that E15 will damage engines, void warranties, and reduce fuel efficiency. In difficult economic times, consumers need to get more miles from a gallon of gas and extend the lives of their cars. EPA's waiver threatens the already precarious financial situation of American families with no discernible environmental benefit.

I have attached all the responses, but want to highlight quotes from each manufacturer:

> Chrysler: "We are not confident that our vehicles will not be damaged from the use of E15 . . . The warranty information provided to our customers specifically notes that use of the blends beyond E10 will void the warranty."
>
> Ford: "Ford does not support the introduction of E15 into the marketplace for the legacy fleet . . . Fuel not approved in the owner's manual is considered misfueling and any damage resulting from misfueling is not covered by the warranty."
>
> Mercedes-Benz: "Any ethanol blend above E10, including E15, will harm emission control systems in Mercedes-Benz engines, leading to significant problems."

Honda: "Vehicle engines were not designed or built to accommodate the higher concentrations of ethanol . . . There appears to be the potential for engine failure."

Mazda: "The record fails to demonstrate that motor vehicles would not be damaged and result in failures when run on E15."

Toyota: "Toyota cannot recommend the use of fuel with greater than E10 for Toyota vehicles currently on the road . . . Our policy remains that we will not provide warranty coverage for issues arising from the misuse of fuels that exceed specified limits."

Nissan: "We are not at all confident that there will not be damage to MY 2001 and later vehicles that are fueled with E15. In our view the record fails to demonstrate that motor vehicles . . . would not be damaged and result in failures when run on E15."

Volkswagen: "Volkswagen agrees that the EPA did not conduct an adequate test program when E15 was considered and then approved for use in conventional vehicles. . . Our current warranty will not cover problems stemming from the use of E15."

Volvo: "The risks related to emissions are greater than the benefits in terms of CO_2 when using low-blend E15 for variants that are designed to E10."

BMW: "BMW Group engines and fuel supply systems can be damaged by misfueling with E15 . . . Damage appears in the form of very rapid corrosion of fuel pump parts, rapid formation of sludge in the oil pan, plugged filters, and other damage that is very costly to the vehicle owner."

Hyundai: "The EPA tests failed to conclusively show that the vehicles will not be subject to damage or increased wear."

Kia: "EPA testing failed to determine that vehicles will not be subject to damage or increased wear."

And the problems do not stop there. On June 22, 2011, I sent a second letter to small engine manufacturers. While the EPA's waiver does not apply to small engines, many small engines are fueled remotely—gasoline is initially filled into a container which is then used to fuel the engine. This creates a substantial risk of misfueling despite the EPA's labeling efforts. In my June 22 letter, I asked small engine manufacturers if they were confident that the EPA had done enough to avoid misfueling and whether they thought E15 would damage their engines. In the limited responses I have received, small engine manufacturers have expressed significant concerns. These responses are also attached.

E15 is a product that simply does not belong in the marketplace. I am writing to urge the EPA to heed these warnings and reconsider its E15 waiver. In furtherance of my work on the House Science, Space and Technology Committee and on behalf of my constituents, please respond to the following questions by July 21, 2011:

1. Did the EPA consider the effects E15 would have on engine durability and fuel efficiency before granting its waiver?
2. Is the EPA confident that E15 will not damage car engines in model years 2001 and later?

3. What effect does the EPA believe that E15 will have on fuel economy?
4. Does the EPA believe that its recent labeling safeguards for E15 will be sufficient to prevent misfueling in car and truck engines older than model year 2011 and in small engines?

I greatly appreciate your prompt response and attention to this matter.

Sincerely,

F. James Sensenbrenner, Jr.
Vice-Chairman, House Committee on Science, Space, and Technology

cc: The Honorable Ralph Hall
Chairman, Committee on Science, Space, and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space, and Technology

KIA MOTORS

Kia Motors Corporation Washington Office
1660 L Street, NW, Suite 201
Washington, DC 20036
Tel: 202-503-1515 Fax: 202-503-1516

July 1, 2011

The Honorable F. James Sensenbrenner, Jr.
Vice-Chairman, House Committee on Science, Space and Technology
United States House of Representatives
Room 2499
Rayburn House Office Building
Washington, DC 20515-5101

Dear Vice-Chairman Sensenbrenner,

Thank you for your June 1, 2011 letter to Kia Group President and Chief Executive Officer Byung Mo Ahn inquiring on Kia's views of ethanol blends and the Environmental Protection Agency (EPA) efforts to change the levels of use by 50 percent or to an E15 level. We are honored to be asked to comment on your work for the House Committee on Science, Space and Technology and are pleased to respond to your specific questions on E15.

Overall, Kia believes more testing is required before introducing a new fuel into the marketplace. Scientific review can determine the positive and negative impact a new fuel can have on air quality, consumer acceptance and engine durability.

We have addressed your questions outlined in the June 1 letter:

Question One on confidence that our cars and trucks from model year 2001 and later will not be damaged by or wear out more quickly from the use of E15; EPA testing failed to determine that vehicles will not be subject to damage or increased wear. Therefore Kia has no basis to conclude that vehicles will not be damaged by or wear out faster due to the use of E15.

Question Two concerning current warranties and potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later; On pages 9-10 of the Warranty Manual, Kia states: " Improper maintenance or the use of other than the specified fuel, oil or lubricants recommended in your Owner's Manual. It is your obligation to ensure that you obtain all fuels, oils and lubricants from reliable vendors using quality products which meet the Kia specifications identified in your Owner's Manual. In the event that problems result to your vehicle due to service from vendors who use reduced quality products, your vehicle warranties will not provide coverage."

KIA MOTORS

Kia Motors Corporation Washington Office
1660 L Street, NW, Suite 201
Washington, DC 20036
Tel: 202-503-1515 Fax: 202-503-1516

Kia's Owner's Manual in section 1, page 3 provides that owner's shouldn't use anything greater than 10% ethanol and that a 15% mixture will damage the vehicle. (Kia Warranty and Owner's Manuals are attached for your review)

Question Three on the effect of E15 on the fuel efficiency of our engines; Kia believes that E15 will lead to degradation in fuel efficiency due to the lower energy content than gasoline.

Thank you for your letter and the opportunity to share our views on E15. If you have further comments or questions, I can be reached on 202 503-1515 or jta@kia-dc.com.

Sincerely,

J. T. Anderson

John T. Anderson
Director, Kia Government Affairs

cc: The Honorable Ralph Hall
Chairman, Chairman Committee on Science, Space and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space and Technology

Mr. Byung Mo Ahn
Group President and Chief Executive Officer
Kia Motors America

HONDA

Honda North American, Inc.
1001 G Street, N.W. Suite 950
Washington, D.C. 20001
Phone (202) 661-4100

June 13, 2011

Hon. F. James Sensenbrenner, Jr.
Vice Chairman
Committee on Science, Space, and Technology
House of Representatives
Washington, D.C. 20515-4905

Dear Mr. Vice Chairman:

Mr. Tetsuo Iwamura, President and Chief Executive Office of American Honda Motor Company, Inc., has asked that I respond to your June 1, 2011, letter regarding the Environmental Protection Agency's recent approval of a blend of 15 percent ethanol (E15) for use in cars and trucks of Model year 2001 or later. You have raised the following three questions:

1. **Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?**

As you know, the Clean Air Act requires motor vehicle manufacturers to certify that the vehicles they sell will meet or exceed emissions standards in effect at the time each vehicle is introduced into commerce. There are specific testing protocols that must be employed for certification, including specifications for fuels used in the vehicles during testing. As a result, we engineer our vehicles to meet or exceed the standards utilizing the prescribed test fuel, which never has contained ethanol. However, given the fuels prevalent in the market over the last decade, the engines in Model Year 2001 later vehicles were built to operate on fuels with ethanol concentrations of up to 10% (E10).

Authorizing the sale of E15 in 2010 for vehicles built after 2001 presents an obvious problem for auto manufacturers – vehicle engines were not designed or built to accommodate the higher concentrations of ethanol. The differences between E10 and E15, including E15's higher oxygen content, lower energy content and heightened corrosivity, require use of more robust component materials and different engine calibrations. The engines in our Model Year 2001 and later vehicles do not have those necessary materials or calibrations.

In our owner's manuals, Honda requires its customers to refuel their vehicles with E10 or below. The impact of E15 on our engines is not completely known at this stage, although there appears to be the potential for engine failure. During the EPA's consideration of the partial waiver approving the use of E15, Honda and its trade association, the Association of International Automobile Manufacturers (AIAM) (now known as Global Automakers), urged the agency to defer its decision until such time as the testing program on the impact of E15 on vehicles is complete. The testing is being managed by the Coordinating Research Council (CRC), an independent organization funded by the automobile and oil industries, with limited contributions from the U.S. government. Honda is a member of the CRC and active in its testing.

It is unfortunate that EPA did not wait for the results of the seven major test programs that are being undertaken by CRC. These programs include critical tests for engine durability and fuel system material compatibility. Potential E15-related failures have already been identified in some of these programs, including the possible confounding of a vehicle's on-board diagnostic system. This can lead to illumination of the "check engine" light when in fact there is no malfunction, or the failure of the light to illuminate when there is a problem.

Because E15 has not been in the market and our engines were not designed for its use, we do not have a detailed understanding of the implications of the widespread use of the fuel in our vehicles. However, these early results from the CRC testing cause us concern. The CRC studies are due to be completed beginning in late-2011.

2. **Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?**

As noted above, Honda products were designed, built and certified to operate on E10 and below. Use of higher blends could compromise the vehicle's warranty.

3. **Will E15 affect the fuel efficiency of your engines?**

Ethanol contains less energy than gasoline on a gallon-for-gallon basis. Accordingly, customers can expect to experience about 5% - 6% inferior fuel economy using E15 rather than E0 (the difference between E10 and E15 will be smaller). Customers using E85 (in a vehicle designed to use E85) instead of E10 will experience about a 27% decrease in fuel economy. For example, a vehicle that gets 300 miles to the tank on today's gasoline will likely achieve only about 219 miles to the tank with E-85.

If you have further questions regarding E15, please feel free to contact me at (202) 661-4400.

Sincerely,

Edward B. Cohen
Vice President
Government & Industry Relations

cc: The Honorable Ralph Hall, Chairman
Committee on Science, Space, and Technology

The Honorable Eddie Bernice Johnson, Ranking Member
Committee on Science, Space, and Technology

CHRYSLER

Jody Trapasso
Senior Vice President
External Affairs

June 23, 2011

The Honorable F. James Sensenbrenner, Jr.
Vice-Chairman
House Committee on Science, Space and Technology
U.S. House of Representatives
2449 Rayburn House Office Building
Washington, DC 20515-4905

Dear Vice-Chairman Sensenbrenner:

Sergio Marchionne asked me to respond to your June 1, 2011 letter requesting information about the Environmental Protection Agency's (EPA or Agency) decisions to allow the use of 15 percent ethanol (E15) in passenger cars and light trucks beginning with the 2001 Model Year (MY).

Beginning in the late 1970's, Chrysler was one of the first automakers to endorse and support the use of "gasohol" (i.e., gasoline with up to 10 percent ethanol, or E10). Since then, all of our conventional gasoline-fueled cars and trucks have been designed and warranted for E10 operation. Chrysler has also produced Flexible-Fuel Vehicles (FFVs) since the 1998 MY and voluntarily committed that 50 percent of our fleet produced by 2012 will be capable of operating on renewable fuels. These vehicles are designed, warranted and developed to operate on gasoline, E85 ethanol or any blend in between.

While Chrysler has been a strong advocate of renewable fuels, we have concerns about the potential harmful effects of E15 in engines and fuel systems that were not designed for use of that fuel. In cooperation with other automakers, we have been conducting tests of vehicles in the 2001 and later model year vintage to assess the effect of E15 on their engines and fuel systems. Prior to EPA's decisions to allow E15, we had requested that the Agency defer from making any decisions regarding higher ethanol blends for conventional vehicles until existing testing programs have been completed and the data fully evaluated.

Chrysler Group LLC | CIMS 936-00-00 | 1401 H Street, NW, Suite 700 | Washington, DC USA | 20005
Phone 202.414.6756 | Fax 202.414.6729 | jody.trapasso@chrysler.com

Provided below are answers to the three specific questions asked in your letter.

1. Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?

No, we are not confident that our vehicles will not be damaged from the use of E15. While future products could be designed to accommodate E15 or other mid-level blends of ethanol, testing to date suggests that both newer and older models (non-FFVs) may experience more engine wear and fuel system damage from the use of E15.

2. Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?

No. Chrysler's conventional vehicles (non-FFVs) are only warranted for use of E10. The warranty information provided to our customers specifically notes that use of blends beyond E10 will void the warranty.

3. Will E15 affect the fuel efficiency of your engines?

Yes. The energy content (Btu/gallon) of fuel decreases as the ethanol concentration increases. As a result, we expect the fuel efficiency of our conventional products (non-FFVs) to decrease with any increase in ethanol content.

I hope that this information responds to your request. Please do not hesitate to contact me if you need any additional information.

Sincerely,

Jody Trapasso

Susan M. Cischke
Group Vice President-Sustainability,
Environment & Safety Engineering

World Headquarters
One American Road
Dearborn, MI 48126-2798 U.S.A

June 8, 2011

The Honorable James Sensenbrenner, Jr.
Vice-Chairman, House Committee on
Science, Space, and Technology
Rayburn House Office Building, Room 2449
Washington, D.C. 20515

Dear Vice-Chairman Sensenbrenner:

Alan Mulally has asked me to respond to your letter of June 1 regarding the introduction of E15 fuel into the marketplace.

At Ford, we recognize the need to increase the use of biofuels to meet the country's goals of energy security and reduced greenhouse gas emissions. Ford has produced, and continues to offer, a substantial number of flexible fuel vehicles (FFV) capable of operating on E85 (85% ethanol) across many models. The renewable fuel standard, passed into law in 2007, requires 36 billion gallons of biofuels to be blended into transportation fuel by 2022. In order to meet that goal, the country needs to increase the use of ethanol beyond the 10% (E10) used today, but needs to do so in a fashion that does not have a negative impact on the legacy fleet.

This can be accomplished by taking a prospective approach to the introduction of mid-level blends whereby manufacturers, provided with enough lead time, can design new vehicles with the capability of accommodating the new fuel. Likewise, the lead time will give fuel providers an opportunity to prepare to make the new fuel available nationwide. In contrast, an approach in which fuel specifications are changed abruptly, and the new fuel is allowed to be used on vehicles that were not designed for it, is likely to lead to undesirable outcomes for consumers, the new fuel, and the legacy vehicles.

Below are answers to your specific questions:

Q1 Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?

Ford does not support the introduction of E15 into the marketplace for the legacy fleet. The entire legacy fleet of non-FFVs, including vehicles built in model year 2001 and later, consists of vehicles that were designed to operate in a range of fuels from pure gasoline up to a blend of 10 percent ethanol (E10) -- not E15. We remain concerned that legacy fleet, operating on a fuel the vehicles were not designed for, will not meet customer expectations for quality, durability, performance and fuel economy, as well as legal requirements to meet emission standards and

on-board diagnostic regulations. Efforts to increase renewable fuel use must be carried out in a way that does not create undue risks and problems for existing vehicles on the road.

Q2 Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?

The owners' manuals for these legacy vehicles do not identify E15 as a fuel that may be used in the vehicles. They go on to say that the use of a fuel not approved in the owners' manual is considered misfueling, and that any damage resulting from misfueling is not covered by the warranty. To the extent that E15 is introduced into commerce, we will work with our customers and dealerships as best we can to address any potential concerns, but we cannot redesign vehicles that have already been built and sold.

Q3 Will E15 affect the fuel efficiency of your engines?

Going from the generally available E10 fuel to E15 will not have a significant impact on the efficiency of the engine, but because ethanol contains less energy per a given volume of fuel, customers will experience slightly lower miles per gallon when driving on E15 versus E10.

Ford appreciates the opportunity to provide our views on this subject. Thanks again for your continued support of the automotive industry.

Sincerely,

Susan M. Cischke
Group Vice President
Sustainability, Environment & Safety Engineering
Ford Motor Company

cc: The Honorable Ralph Hall
Chairman, Committee on Science, Space, and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space, and Technology

Mazda North American Operations

James J. O'Sullivan
President and CEO

June 7, 2011

The Honorable F. James Sensenbrenner
Vice-Chairman
House Committee on Science, Space and Technology
United States House of Representatives
2449 Rayburn House Office Building
Washington, D.C. 20515-4905

Dear Vice-Chairman Sensenbrenner:

We appreciate receiving your June 1, 2011 letter regarding EPA's two partial waiver decisions that permit the sale of gasoline containing up to 15 percent ethanol (E15) for 2001 model year (MY) and newer passenger cars and light trucks. We believe that increasing the allowable ethanol content in gasoline by 50 percent will have unintended consequences for auto manufacturers, consumers, fuel suppliers and distributors. Mazda's primary concern about an E15 waiver is the overriding need for consumer satisfaction.

Specifically, your letter asks for responses to the following three questions. Our responses are provided below.

1. **Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?**

   No, we are not at all confident that there will not be damage to MY 2001 and later vehicles that are fueled with E15. In our view, the record fails to demonstrate that motor vehicles (other than FFVs) would not be damaged and result in failures when run on E15. No Mazda vehicles were included in the models tested by the government.

2. **Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?**

   Mazda vehicles covered by the waiver were designed to use a maximum of E10. The direction in the owner guides of Mazda vehicles reflects the fact that they were not designed to run on E15. EPA regulations allow manufacturers to deny warranty coverage for vehicles damaged due to mis-fueling (based on the owner's manual instructions). We are encouraging Mazda vehicle owners to continue to consult their owners' manuals for information regarding the appropriate fuel for their vehicles.

7755 Irvine Center Drive Irvine, CA 92618-2922 Telephone 949 727 1990
PO Box 19734 Irvine, CA 92623-9734 Facsimile 949 727 6529 Internet http://www.mazdausa.com

Mazda owner's manuals specify the following:

> *"Your vehicle can use only oxygenates that contain no more than 10 percent ethanol by volume. Harm to your vehicle may occur when ethanol exceeds this recommendation, or if the gasoline contains any methanol."*
>
> *"Vehicle damage and drivability problems resulting from the use of the following may not be covered by the Mazda warranty.*
> - *Gasohol containing more than 10% ethanol.*
> - *Gasoline or gasohol containing methanol.*
> - *Leaded fuel or leaded gasohol."*

3. **Will E15 affect the fuel efficiency of your engines?**

   Yes. A gallon of ethanol has lower energy content than a gallon of gasoline. Therefore, any increase in ethanol content will necessarily degrade fuel economy.

Thank you for considering our views. If you have any questions about this information, please contact Barbara Nocera at bnocera@mazdausa.com or 202.467.5096.

Sincerely,

James J. O'Sullivan

cc: The Honorable Ralph Hall
Chairman, Committee on Science, Space, and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space, and Technology

BMW Group

June 23, 2011

The Honorable F. James Sensenbrenner, Jr.
Vice-Chairman
House Committee on Science, Space, and Technology
United States House of Representatives
Washington, DC 20515-4905

Dear Mr. Vice-Chairman:

This is in response to your June 1, 2011 letter regarding the recent approvals by the EPA to permit a gasoline blend of 15 percent ethanol (E15) for use in model year 2001 and later passenger cars and light trucks. Our Chairman asked me to respond to your request.

On behalf of BMW of North America, LLC (BMW NA), please find below your questions followed by our answers.

1. *Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?*

   BMW NA Response: No. BMW Group engines and fuel supply systems can be damaged by misfueling with E15. BMW has designed its engines and fuel systems to operate with gasoline up to E10 and our owners have already experienced damage when, for example, a gasoline terminal mixes greater than 10% ethanol into the tanker. As a result of periodic damage, BMW NA has issued Service Information Bulletins (attached) warning of potential damage, and our dealers have ethanol test kits to measure the percentage of ethanol in the vehicle's tank.

   Damage appears in the form of very rapid corrosion of fuel pump parts, rapid formation of sludge in the oil pan, plugged filters, and other damage that is very costly to the vehicle owner.

   As you would expect, engines and fuel systems already on the road cannot be retroactively designed to be compatible with ethanol blends higher than used for the original design.

2. *Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?*

   BMW NA Response: No. Our warranty states that it does not cover malfunctions caused by use of fuels containing more than 10% ethanol. Our dealers have an alcohol detection tool to identify ethanol blends that exceed the allowable 10% maximum. We anticipate that the owners of vehicles damaged by higher levels of ethanol will be frustrated, notwithstanding the warnings contained in our warranty booklets.

Company
BMW of North America, LLC

BMW Group Company

Office address

200 Chestnut Ridge Road
Woodcliff Lake, NJ 07677

Telephone
(201) 571-5071

Fax
(201) 671-5479

E-mail
Tom.Beloga@bmwna.com

3. Will E15 affect the fuel efficiency of your engines?

Response: Yes. Engine compression ratios, turbo-charging pressures, and control mapping are designed to optimize fuel economy, performance, and emissions based on a maximum of E10. Since ethanol has about 34% less energy than gasoline, an engine designed to run on up to E10 will suffer a corresponding loss in fuel economy. More importantly, use of ethanol blends higher than E10 in the wrong engines will result in drivability problems at high and low temperatures including hard starting, stalling, and hesitation.

Recommendations

BMW NA respectfully makes the following recommendations if increased percentages of ethanol in gasoline are required:

- Legacy E10 gasoline must be required by law for the next 15 years to accommodate vehicles, motorcycles, and other power equipment currently in use that would be damaged by E10+.
- Implementation of effective efforts to prevent misfueling, including requiring strong language on pump labels on E10+ pumps that warn of damage from misfueling and advise users to "Check your owner's manual for ethanol warnings," and consider the use of a different nozzle size for E10+ pumps to diminish the chance of inadvertent misfueling.
- An ethanol misfueling owner reimbursement clearinghouse, funded by the ethanol industry, should be established by law to allow owners to recoup repair costs from misfueling damage. Vehicle OEMs and gas station owners should be indemnified from damages caused by misfueling.
- By law, before a gas station storage tank is filled with ethanol blends greater than E0 or E10 for the first time, the tank must be cleaned and filters installed to prevent newly-dissolved dirt caused by water and alcohol from being pumped into consumers' tanks.
- In general, we favor the introduction of an increase to E20 in ethanol content <u>together with</u> a 5 year minimum lead time for engine and fuel system developers.

If you or your staff has further questions, please contact me at 201-571-5071.

Sincerely,

Thomas C. Baloga
Vice President,Engineering US

cc: The Honorable Ralph Hall
Chairman, Committee on Science, Space, and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space, and Technology

Enclosures

Service Information

This Service Information bulletin replaces SI B13 04 06 dated August 2006.

SUBJECT

Testing Fuel Composition

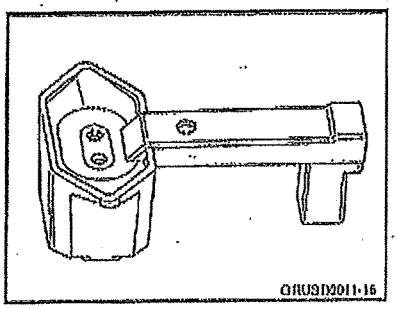
MODEL

All

SITUATION

Fuel blends containing a high percentage of alcohol (10% and above), mainly ethanol, are becoming more commercially available. Usage of E85 or any other high alcohol content blend (e.g., E30) in BMW vehicles will cause various drivability complaints (cold start problems, stalling, reduced performance, poor fuel economy, etc.); may cause excessive emissions; and may cause irreversible damage to engine, emission control and fuel delivery systems due to incompatibility of materials with alcohols. Refer to SI B13 01 06 Alcohol Fuel Blends in BMW Vehicles for complete details.

In order to correctly diagnose various drivability complaints caused by fuel blends with a high level of ethanol content, BMW is providing you with an electronic fuel composition tester.



Fuel Composition Tester
P/N 83 30 0 439 685

Refer to B04 04 11 for more details.

PROCEDURE

Safety Precautions:

- Gasoline is highly flammable; observe normal precautions for working with flammable liquids. Perform all tests away from any source of ignition. A class B fire extinguisher must be available.
- Wear protective eye protection with side shields and Nitrile rubber gloves for handling the tester.
- Please adhere to any applicable OSHA regulations when handling gasoline.
- Dispose of the mixture according to local, state and federal regulations.

Refer to the attached procedure for testing the fuel composition of gasoline.

WARRANTY INFORMATION

Component damage, malfunctions, or any drivability problems verified to be caused by the use of fuels containing more than 10% ethanol (or other oxygenates with more than 2.8% oxygen by weight) will not be covered under BMW warranties as this is not considered a defect in materials or workmanship. Always document the results found on the vehicle repair order whenever performing this test.

Service Information

This Service Information bulletin supersedes SI B13 01 06 dated September 2006.

Changes to this revision are identified by a black bar.

SUBJECT

Alcohol Fuel Blends in BMW Vehicles

MODEL

All with gasoline engines

SITUATION

Fuel blends containing a high percentage (above 10%) of alcohol, mainly ethanol, are becoming more commercially available. Customers inquire about the possibility of using alcohol fuels (e.g., E85) in BMW vehicles.

INFORMATION

Fuels containing up to and including 10% ethanol; or other oxygenates with up to 2.8% oxygen by weight, that is, 15% MTBE (methyl tertiary butyl ether); or 3% methanol plus an equivalent amount of cosolvent will not void the applicable warranties with respect to defects in materials or workmanship.

Usage of such alcohol fuel blends may result in drivability, starting, and stalling problems due to reduced volatility and lower energy content of the fuel. Those drivability problems may be especially evident under certain environmental conditions such as high or low ambient temperatures and high altitude.

Only specially adapted vehicles (FFV - Flexible Fuel Vehicles) can run on high alcohol fuel blends. BMW, for the various technical and environmental reasons explained below, does not offer FFV models.

Usage of E85 or any other high-alcohol content blend (e.g., E30) in BMW vehicles will cause various drivability complaints (cold-start problems, stalling, reduced performance, poor fuel economy, etc.); may cause excessive emissions; and may cause irreversible damage to engine, emission control and fuel delivery systems due to incompatibility of materials with alcohols.

General Notes Regarding E85 Fuel

E85 fuel contains 85% (by volume) ethanol and 15% gasoline. Ethanol can be produced chemically from ethylene or biologically from grains, agricultural wastes, or any organic material containing starch or sugar. In the US, ethanol is mainly produced from corn and is classified as a renewable fuel.

Similar to gasoline, ethanol contains hydrogen and carbon with additional oxygen molecules built into its chemical chain. This chemical structure makes ethanol's burning process slightly cleaner than gasoline (lower tailpipe emissions).

On the other hand, due to lower carbon content, ethanol provides 27% less energy (for identical volume) than gasoline, resulting in reduced fuel economy of E85 vehicles (approximately 22% higher consumption). Increased fuel consumption requires appropriately enlarged fuel tank capacities (usually a 30% increase), and specific DME calibrations for E85 lower stoichiometric air/fuel ratio (10 compared to 14.7 for gasoline engines).

E85 fuel volatility is typically lower than gasoline (RVP 6-10 psi, compared to 8-15 psi for gasoline). Lower fuel volatility will reduce vehicle evaporative emissions, but it may cause cold-starting problems, especially with lower ambient temperatures.

Under certain environmental conditions, mainly lower ambient temperatures, ethanol separates from the gasoline/alcohol mixture and absorbs water. The ethanol-absorbed water molecules are heavier than gasoline or ethanol; they remain at the bottom of fuel tank and, when introduced into the combustion process, they tend to form an extremely lean mixture resulting in misfire, rough idle and cold-starting problems.

Certain materials commonly used with gasoline are totally incompatible with alcohols. When these materials come in contact with ethanol, they may dissolve in the fuel, which may damage engine components and may result in poor vehicle drivability.

Some metals (e.g., zinc, brass, lead, aluminum) become degraded by long exposure to ethanol fuel blends. Also, some nonmetallic materials used in the automotive industry such as natural rubber, polyurethane, cork gasket material, leather, polyvinyl chloride (PVC), polyamides, methyl-methacrylate plastics, and certain thermo and thermoset plastics degrade when in contact with fuel ethanol.

In order to safely and effectively operate a motor vehicle running on E85, the vehicle must be compatible with alcohol use. Some manufacturers have developed vehicles called FFV (Flexible Fuel Vehicle) that can operate on any blend of ethanol and gasoline (from 0% ethanol and 100% gasoline to 85% ethanol and 15% gasoline). Ethanol FFVs are similar to gasoline vehicles, with main differences in materials used in fuel management and delivery systems, and DME control module calibrations. In some cases, E85 vehicles also require special lubricating oils.

Aftermarket conversions of gasoline-powered vehicles to ethanol-fueled vehicles, although possible, are not recommended, due to internal materials and DME software incompatibility as well as the high costs of conversion.

In order to correctly diagnose various drivability complaints caused by fuel blends with a high level of ethanol content, refer to SI B13 05 10, Testing Fuel Composition for applicable tools and procedures.

WARRANTY INFORMATION

Components damage/malfunctions or any drivability problems caused by the use of fuels containing more than 10% ethanol (or other oxygenates with more than 2.8% oxygen by weight) will not be covered under BMW warranties with respect to defects in materials or workmanship.

Mercedes-Benz

Mercedes-Benz USA, LLC
Ernst H. Lieb
President and CEO

June 10, 2011

The Honorable F. James Sensenbrenner, Jr.
2449 Rayburn House Office Building
Washington, DC 20515-4905

Dear Congressman Sensenbrenner:

Thank you for your letter regarding the Environmental Protection Agency's (EPA) decision to approve E15 for use in cars and trucks of Model Year 2001 or later. I appreciate the opportunity to respond to your inquiry.

Biofuels play an important part in strengthening our nation's energy security. But, like you, I am concerned over the EPA's decision to grant a waiver for E15 use in certain model year cars and trucks. A premature introduction of E15 into the marketplace will heighten consumer confusion and undercut studies already underway that aim to evaluate the effects of increased ethanol blends on vehicle parts and systems.

As you may know, numerous organizations across the United States have commented on the EPA's decision. Automakers are not alone in voicing their opposition. Among others, the auto industry is joined by organizations representing agriculture, small engine manufacturers, and small business owners in uniformly opposing this premature decision on ethanol.

Throughout its operations in the U.S., Mercedes-Benz has provided the most advanced engine and emission control systems to meet the requirements of the U.S. market. All current Mercedes-Benz fleet vehicles and series model lines up to MY 2011 are designed and tested for the use of E10. We have relied on this E10 blend wall in our vehicle design, and any ethanol blend above E10, including E15, will harm emissions control systems in Mercedes-Benz engines, leading to significant problems with certification, in-use testing, emissions performance and fuel economy.

Mercedes-Benz customers who misfuel with E15 will force the Company to face a host of product liability actions. Although the Mercedes-Benz warranty in the owner's manual is clearly restricted to claims involving "proper maintenance," it would be impossible for the Company to prove that the vehicle damage is due to customer misfueling.

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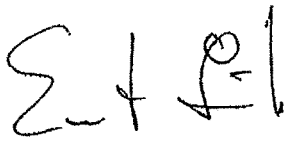
The deterioration, early wear, and aging process depend on how much and how often customers misfuel. Thus, Mercedes-Benz and other manufacturers will be forced into legal actions at a serious disadvantage.

More information on the compatibility of higher ethanol blends in vehicles must be obtained–we simply need more research on the possible negative effects this could have on engines and vehicle components.

At Mercedes-Benz, consumer satisfaction is paramount. Anything that might jeopardize our customer's perception of quality, performance, and safety of a Mercedes vehicle is of deep concern. For this reason, we have steadfastly opposed the EPA's decision to increase ethanol blends without full, comprehensive study. I am pleased that auto manufacturers have been joined by dozens of other associations and industries in voicing similar objections.

Congressman, thank you for your leadership on this issue. Again, thank you for contacting me.

Sincerely,



TOYOTA

TOYOTA MOTOR NORTH AMERICA, INC.

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June 13, 2011

The Honorable F. James Sensenbrenner, Jr.
Vice Chairman
House Committee on Science, Space, and Technology
Room 2449 Rayburn House Office Building
Washington, DC 20515

Dear Vice Chairman Sensenbrenner:

I am writing in response to your June 1, 2011 letter to James Lentz concerning the Environmental Protection Agency's (EPA's) approval of E15 for use in 2001 model year and later vehicles.

Toyota strongly supports the development of alternative fuels to help reduce dependence on foreign oil and potentially reduce vehicle emissions. However, along with many other automobile manufacturers, Toyota is concerned about the EPA waivers approving use of E15 for 2001 model year and newer vehicles. As you may know, Toyota is a member of the Alliance of Automobile Manufacturers and the Association of Global Automakers, and these trade associations have joined with the National Marine Manufacturer's Association and the Outdoor Power Equipment Industries to challenge EPA's E15 waiver decisions.

Listed below are the questions from your letter along with Toyota's response:

1) Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?

   RESPONSE: With the exception of the Flexible Fuel Vehicle (FFV) versions of our Tundra and Sequoia (which were designed specifically for the higher ethanol-based fuel), all Toyota, Lexus and Scion models on the road today have only been designed for fuels with up to 10% ethanol (E10). Moving from E10 to E15 represents a 50% increase in the alcohol content of the fuel compared to what the vehicles were designed to accept. Unfortunately, the data considered in connection with EPA's E15 waivers does not adequately determine the effect of this change on Toyota's legacy fleet. Accordingly, Toyota cannot recommend the use of fuel with greater than E10 (10% ethanol) for Toyota vehicles currently on the road, except for the FFV's.

2) Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?

RESPONSE: The vehicle owner's manual for Toyota, Lexus and Scion vehicles clearly recommends against using fuels with ethanol content greater than 10%, except for the FFV's, which can use fuels up to 85% ethanol. Our policy remains that we will not provide warranty coverage for issues arising from the misuse of fuels that exceed specified limits.

3) Will E15 affect the fuel efficiency of your engines?

RESPONSE: Because a gallon of ethanol has lower energy content than a gallon of gasoline, higher level ethanol blends will generally result in lower real-world vehicle fuel economy.

Toyota recognizes that ethanol and other renewable fuels will continue to play an important role in US energy policy. But, rather than pursue a *retrospective* solution that carries substantial risks for consumers, automakers, equipment makers and fuel providers, we need a *prospective* solution that provides adequate lead time for vehicle development, fueling infrastructure modifications and misfueling prevention measures. In support of this notion, and to avoid a continually moving target, Toyota stands ready and willing to develop E20 compatible vehicles in the future provided these issues are addressed.

We welcome the opportunity to work with key stakeholders in Congress, the regulatory agencies, the auto industry, the fuel industry and others to examine a practical pathway forward. Please contact me if you have any questions or need any additional information.

Sincerely,

Thomas J. Lehner
Vice President, Government & Industry Affairs
Toyota Motor North America

VOLKSWAGEN

GROUP OF AMERICA

MICHAEL LOHSCHELLER
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June 9, 2011

The Honorable F. James Sensenbrenner, Jr.
Vice-Chairman, House Committee on Science, Space, and Technology
U.S. House of Representatives
2449 Rayburn House Office Building
Washington, D.C. 20515-4905

Dear Congressman Sensenbrenner,

Thank you for your June 1 letter to Jon Browning inquiring about Volkswagen Group of America's position on EPA's decision to allow E15 for use in cars and trucks of model year 2001 or later. Mr. Browning is out of the country and has asked that I respond on his behalf. We appreciate your leadership on this issue and support your legislation to block the implementation of this rule. Below please find our responses to your questions.

1. Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?

Volkswagen does not have complete confidence that our vehicles will have no problems related to the use of E15. During the development of existing products no manufacturer tested for E15, since this fuel was not considered as a possible fuel when these vehicles were designed and tested. There is risk that a population of these existing vehicles could experience some type of problem due to E15.

Volkswagen agrees that the EPA did not conduct an adequate test program when E15 was considered and then approved for use in conventional vehicles. The auto and petroleum industry, through the CRC organization, conducted some limited testing of five vehicle areas where it was felt E15 could cause problems with some population of 2001 and newer vehicles. These five areas of concern are the following: base engine durability, catalyst durability, fuel system components, evaporative emissions systems and on board diagnostic (OBD) systems. The CRC testing indicated that some vehicles may be subject to problems related to E15 in the areas mentioned. It is possible that Volkswagen vehicles are included in the population of vehicles that could experience problems.

2. Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?

No. Our current warranty will not cover problems stemming from the use of E15. Our owner's manuals currently recommend the use of E10 fuels. We disagree with the EPA decision to allow E15 in 2001 and newer vehicles and our advice to our customers is to follow the recommendation found in the owner's manual.

3. Will E15 affect the fuel efficiency of your engines?

Yes, E15 will affect fuel economy negatively. Ethanol has less energy content than gasoline and a higher percentage of ethanol will result in lower fuel economy. Ethanol has higher octane but there is no assurance the increased ethanol will raise the octane of the fuel, since the octane of the base gasoline can be lowered if a higher level of ethanol is used.

In summary, Volkswagen Group of America supports renewable fuels and increased use of ethanol, but disagrees with the EPA's approach to use a higher blend in older vehicles not designed to use this fuel. A more sensible approach is to set a higher level blend in the future with adequate lead time for the industry to design their vehicles to the prescribed higher blend level. The blend level should be set such that the RFS II requirements are fulfilled. The result would be vehicles designed for and optimized to a new higher ethanol fuel. This new fuel should also have a new requirement for a higher octane value that vehicle manufacturers can design to in order to optimize CO2 emissions. Finally, E10 should remain on the market for legacy product.

Again, thank you for recognizing this issue as problematic for manufacturers, and ultimately consumers. Please do not hesitate to contact our Vice President of Government Relations, Anna Schneider, with further questions.

Sincerely,

Michael Lohscheller

cc: Anna Schneider

VOLVO
Volvo Car Corporation

The Honorable F. James Sensenbrenner, Jr., Vice-Chairman
House Committee on Science, Space, and Technology
Room 2449
Rayburn House Office Building
Washington, DC 20515-4905

Date	Telephone indialling	Telefax	Our reference
2011-06-02			

Dear Vice-Chairman Sensenbrenner:

In response to your letter of June 1, 2011 regarding possible concerns of Volvo Car Corporation (VCC) and other constituents about EPA's recent approval of a blend of 15 percent ethanol (E15) for use in cars and trucks of Model Year 2001 or later, Volvo would like to offer the following answers to the questions posed in your letter.

1. Damage or wear from the use of E15 in model year 2001 and later Volvo vehicles: Volvo would expect accelerated engine wear and reduced durability over the lifetime of any vehicle engine subjected to E15 use. Field studies done at markets with rising blends above E10 has shown signs of premature ageing of rubber components in the fuel distribution system, which poses an increased risk regarding evaporative emissions. Volvo vehicles currently meet evaporative and exhaust emission performance and durability requirements using fuel containing not more than 10 percent ethanol (E10). While wear and tear at the federal useful life standard of 10 years/120,000 miles would already be concerning, California's Zero Emission Vehicle useful life standard of 15 years/150,000 miles would pose an even greater concern.

   Volvo currently markets modified variants that can handle higher levels of ethanol than E10 in some markets
   - Volvo has not currently scheduled to include variants in the U.S. market that can cope with higher ethanol concentrations than 10%
   - We can not modify already produced cars to minimize the risk of the described customer and environmental problems.

2. Warranty coverage of potential problems stemming from the use of E15: Volvo owner's manual specifies a maximum 10 percent allowable ethanol content. The owner's manual also stresses the importance of proper vehicle care and maintenance, including the use of approved fuels, fluids, and lubricants.

Volvo's warranty, spelled out in a Warranty and Maintenance Records Information booklet, reserves the right to deny warranty coverage for damage caused by or under limited but specific circumstances, which expressly include:

"The use of fuel and/or oil, or other fluids which do not meet the Volvo-approved standards as set forth in the Owner's Manual, Volvo Service Literature or [in this] booklet."

However, it must also be understood that federal law puts the burden on the manufacturer to prove cause of emission failure. Therefore, any manufacturer would be prevented from arbitrarily assigning blame to the use of E15; such a determination must be supported by evidence. That kind of evidence can be elusive, given the uncertainty of histories of use of most motor vehicles.

3. E15's effect on vehicle fuel consumption: Ethanol contains less energy than gasoline. E10 already causes an increase in fuel consumption over unblended fuel. Volvo estimates that an increase in ethanol to 15 percent will degrade fuel economy and increase fuel consumption by a further 2.5 percent.

4. E15, an environmental aspect

Bringing a higher content of ethanol in the existing fuel market can be an opportunity to introduce alternative fuels. If focusing on the environmental aspect, the introduction of alternative fuels is in general a multistep process, the impact on the source of fuel and how it used.
Important environmental benefit is a reduction of the use of fossil fuels and replacing it with renewable fuel. In other words, it affects the CO2 balance positively.
The low-blend of ethanol, E10 and E15, causes fuel consumption to increase as described in paragraph 3 but CO2 emissions are expected to be unchanged or better when used. According to Volvo's calculations, CO2 emissions from E15 will be roughly equivalent to E10.

In this case, where the E15 is made available for all passenger car types from MY2001 designed to E10 but not E15, arises an environmental dilemma. The benefits when you utilize E10 to E15 to reduce CO2 the effect does not occur, it remains unchanged.
As described in paragraph 1, it is Volvo's engineering assessment that there is a likelihood of accelerated engine wear and rubber fuel system components are most likely to age prematurely, thus, adding an emission risk with respect to evaporative emissions.

Volvo's summation leads to the conclusion that by introducing the E15 for variants that are designed to E10, will add to the risk associated with respect to emissions while there is

VOLVO

Volvo Car Corporation

a no significant improvement in CO2 when using E15 instead of E10. Thus arise the conclusion that the risks related to emissions are greater than the benefits in terms of CO2 when using low-blend E15 for variants that are designed to E10. Thank you for considering our views. If you have any questions about the information, please contact Katherine Yehl at kyehl@volvocars.com or (202) 412-5935.

Sincerely,

Doug Speck
President and CEO
Volvo Cars of North America, LLC

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June 30, 2011

The Honorable F. James Sensenbrenner
Vice-Chairman
Committee on Space, Science and Technology
United States House of Representatives
2449 Rayburn House Office Building
Washington, DC 20515-4905

Dear Vice-Chairman Sensenbrenner:

Thank you for your June 1, 2011 letter to John Krafcik, President, Hyundai Motor America ("Hyundai") regarding the Environmental Protection Agency's (EPA) partial waiver decisions permitting the use of gasoline blended with up to 15 percent ethanol (E15) in 2001 model year (MY) and newer passenger cars and light-duty trucks.

Hyundai recommends that before any new fuel is introduced into the marketplace, comprehensive, independent and objective scientific testing be completed to show that the fuel will not increase air pollution, harm engines, or endanger consumers. Further, Hyundai recommends the establishment of adequate protections to prevent misfueling.

Your letter asks for responses to several questions regarding E15. The questions and Hyundai's responses are shown below.

1. Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly for use of E15?

   The EPA tests failed to conclusively show that the vehicles will not be subject to damage or increased wear. Hyundai therefore has no basis to conclude that its vehicles will not be damaged by or wear more quickly due to the use of E15.

2. Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?

   Hyundai owner's manuals state: "Vehicle damage or drivability problems may not be covered by the manufacturer's warranty if they result from the use of gasohol containing more than 10 percent ethanol..." The manuals also state "Do not use gasohol (gasoline-ethanol mixture) containing more than 10 percent ethanol...".

3. Will E15 affect the fuel efficiency of your engines?

   E15 will negatively affect the fuel efficiency of Hyundai engines because ethanol has lower energy content than gasoline.

Thank you for the opportunity to share our recommendations and to respond to your questions. If you have any questions about this information, please me at kmhennessey@hyundai-dc.com or at 202-296-5550.

Sincerely,

Kathleen M. Hennessey
Vice President – Government Affairs

cc: The Honorable Ralph Hall
Chairman, Committee on Science, Space and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space and Technology

John Krafcik
President, Hyundai Motor America

NISSAN

Andrew J. Tavi
VP Legal and Government Affairs,
and General Counsel

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June 17, 2011

The Honorable F. James Sensenbrenner, Jr.
Vice Chairman
House Committee on Science, Space and Technology
United States House of Representatives
2449 Rayburn House Office Building
Washington, DC 20515-4905

Dear Vice Chairman Sensenbrenner:

We appreciate receiving your letter dated June 1, 2011 regarding EPA's two partial waiver decisions that permit the sale of gasoline containing up to 15 percent ethanol (E15) for 2001 model year (MY) and newer passenger cars and light trucks. We believe that increasing the allowable ethanol content in gasoline by 50 percent will have unintended consequences for auto manufactures, consumers, fuel suppliers and distributors. Nissan's primary concern about these E15 waivers is the overriding need for consumer safety and satisfaction.

Specifically, your letter asks for responses to the following three questions. Our responses are provided below.

1. **Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?**

   No, we are not at all confident that there will not be damage to MY 2001 and later vehicles that are fueled with E15. In our view the record fails to demonstrate that motor vehicles (other than FFVs) would not be damaged and result in failures when run on E15.

2. **Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?**

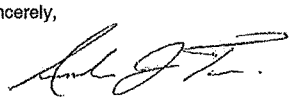
   No. Nissan vehicles covered by the waiver were designed to use a maximum of E10. The direction in the owner manuals of Nissan vehicles reflects the fact that they were not designed to run on E15. EPA regulations allow manufactures to deny warranty coverage for vehicles damaged due to mis-fueling (based on the owner's manual instructions). We are encouraging Nissan vehicle owners to continue to consult their owner's manuals for information regarding the appropriate fuel for the vehicles.

3. **Will E15 affect the fuel efficiency of your engines?**

   Yes. A gallon of ethanol has lower energy content than a gallon of gasoline. Therefore, any increase in ethanol content will necessarily degrade fuel economy.

Thank you for considering our views. If you have any questions about this information, Please contact Tracy Woodard at tracy.woodard@nissan-usa.com or 615-725-2377.

Sincerely,



Andrew J. Tavi
Vice President, Legal and Government Affairs,
and General Counsel

CC: The Honorable Ralph Hall
Chairman, Committee on Science, Space and Technology

The Honorable Eddie Bernice Johnson
Ranking Member, Committee on Science, Space and Technology

Robert E. Ferguson
Vice President
Global Public Policy

General Motors Company
25 Massachusetts Avenue, NW
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Via Fax: 202-225-3190

July 6, 2011

The Honorable F. James Sensenbrenner, Jr.
United States House of Representatives
2449 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Sensenbrenner:

Thank you for your letter of June 1, 2011, to General Motors Chairman and CEO, Dan Akerson, regarding EPA's recent approval of a partial waiver for use of E15 in light duty cars and trucks for model years 2001 and later. The questions that you raise in your letter are certainly timely and important.

General Motors, as part of the Alliance of Automobile Manufacturers, has commented extensively to EPA on the potential adverse effects of increasing ethanol content in gasoline by 50% and allowing its use in vehicles not designed for its use. In addition to the concerns expressed in our specific responses to your questions regarding the 2001 and newer model year products provided below, we are very concerned about the possibility of mis-fueling in pre-2001 vehicles and our marine products in contravention of EPA intentions and regulations. It is clear to us, as it is to others, that the controls envisioned by EPA will not prevent such mis-fueling situations from occurring.

With regard to the specific questions raised in your letter, the following are our specific responses:

1. Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from the use of E15? **Response:** No, we are not confident that our cars and trucks from model year 2001 and later will be undamaged by the use of E15 nor are we confident that they will not wear more quickly from the use of E15. As Administrator Jackson made clear in her remarks, EPA's analysis focused on the effects of E15 on emissions systems rather than overall durability. GM, along with many others, encouraged EPA to wait for on-going testing to be completed prior to making a decision on the E15 waiver request.

The Coordinating Research Council (CRC)* is managing several on-going tests. One of these has documented deterioration in engine valve sealing in late model vehicles as a result of E15 and E20 usage. This deterioration was expected to a degree, because modifications were made to these components for use in vehicles designed to operate on E85. Some proportion of vehicle engines that were not designed for E85 use are likely to prove sensitive to increased ethanol levels and the CRC testing is finding that to be the case.

Another CRC test program has discovered anomalous performance of tank fuel system components. Again, many of these components are upgraded for ethanol tolerance on Flexfuel vehicles. A program to follow-up these screening tests is now being started to develop statistical data.

CRC testing also predicts an increase in vehicle performance problems that will trigger illumination of the vehicle Malfunction Indicator Light (MIL) as a result of increased ethanol in the fuel. This malfunction would not represent a real vehicle fault and the correction would be a return to the recommended fuel. Concerns have been raised with the EPA by the New York Department of Environmental Quality, among others, about how these false MILs would affect driver's response to illuminated MILs and the state inspection and maintenance programs that rely on these signals. Further testing to confirm this result is on-going.

There are five CRC test programs on-going. Three of these, Base Engine Durability, On-Board Diagnostics (OBD) Evaluation, and Vehicle Fuel Systems Durability, are expected to finish in 2011. The other two, Evaporative Emissions Durability and Emissions Inventory and Air Quality Modeling, are expected to complete in 2012. These are lengthy test programs because durability effects over a substantial portion of a vehicle's like cannot be evaluated quickly nor without rigorous vehicle testing.

2. Will your current warranty cover the potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later? **Response:** Our current owner's manuals instruct owners not to use fuel containing more than 10% ethanol unless they are FlexFuel vehicles. Not following these instructions would constitute mis-fueling. Vehicle damage attributed to mis-fueling would not be covered under the new vehicle warranty.

3. Will E15 affect the fuel efficiency of your engines? **Response:** The increased ethanol content will affect vehicle volumetric fuel economy (MPG), which is what our customers are most concerned about. Ethanol has only two thirds the volumetric energy content of gasoline. Adding 5% ethanol to E10, making E15, should reduce vehicle volumetric fuel economy by approximately 1.7%. This would make a total reduction relative to gasoline of approximately 5.1%. DOE testing cited by EPA in its E15 waiver has extensively documented fuel economy losses that match these theoretical predictions.

We hope these answers help frame the issues that still need to be fully addressed in evaluating the appropriateness of EPA granting an E15 waiver. Thank you for inquiring about these important issues.

Sincerely,

Robert E. Ferguson

* http://www.crcao.org/about/index.html ,
http://www.crcao.org/news/Mid%20Level%20Ethanol%20program/index.html

June 23, 2011

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The Honorable F. James Sensenbrenner, Jr.
Vice-Chairman, House Committee on Science, Space and Technology
United States House of Representatives
Room 2449 Rayburn House Office Building
Washington, D.C. 20515-4905

Dear Vice-Chairman Sensenbrenner,

This is in response to your letter dated June 1, 2011 regarding EPA's partial waiver decisions that would allow E 15 gasoline (gasoline containing 15% ethanol) to be sold and used in vehicles manufactured from the 2001 and newer model years. We thank you for the opportunity to respond to your questions on this topic which would affect our customers, their vehicles and our company.

With the proposed additional increase in ethanol (up 50% from existing allowable) to 15%, we believe that negative consequences will result. Subaru wants to be sure that any change would not adversely affect the safety, drivability and emissions of our vehicles as well as customer's satisfaction.

The specific questions you have asked are repeated below along with our responses. .

1. **Are you confident that your cars and trucks from model year 2001 and later will not be damaged by or wear more quickly from use of E15?**

No, we are not confident that our 2001 model year or later vehicles will not be damaged by the use of E15 in them. Since no Subaru models were included in the testing that had been conducted to support EPA's decision, there is no evidence that our vehicles would not be damaged or continue to be reliable as originally designed.

2. Will your current warranty cover potential problems stemming from the use of E15 in cars and trucks from model year 2001 and later?

No. Subaru vehicles designed and manufactured in the 2001 or later timeframe, were constructed to use up to a 10% ethanol mix (E10). Customers are instructed that for proper operation of their vehicles that no more that 10% ethanol fuel should be used. It is stated in the owner's manual that fuel system damage or drivability problems which result from the use of improper fuel are not covered under the Subaru limited warranty.

3. Will E15 affect the fuel efficiency of your engines?

Yes, since the energy content is less in ethanol, when blended with gasoline the net effect is a lower energy concentrated mixture, so comparatively more fuel would be required for the equivalent amount of work.

I hope our responses are helpful. Should you have any further questions, please contact Maurice Arcangeli at 856-488-3115 marcangeli@subaru.com .

Sincerely,

Subaru of America, Inc.

Thomas J. Doll
Executive Vice President & COO