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To: Urban Air Initiative

From: Adam R.F. Gustafson

Re: EPA Emails Show the Agency Relied on the Oil Industry to Design Anti-Ethanol Fuel Effects Study

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Through a Freedom of Information Act ("FOIA") request submitted by Boyden Gray & Associates, Urban Air Initiative ("UAI") has discovered that EPA relied heavily on the oil industry to design the matrix of test fuels used in an influential and deeply flawed fuel effects study known as the EPAct study. EPA invited this involvement from oil industry employees and from the Coordinating Research Council ("CRC"), a group funded by the oil industry. In exchange, EPA sought and received valuable in-kind support from the oil industry.

This new evidence of collusion between EPA and Chevron, BP, and CRC is important, because EPA used the results of the EPAct study to update its vehicular emissions model, MOVES2014, which States must use when they develop policies to comply with EPA's air quality standards. As a result of the oil industry's influence, the model reports that ethanol increases emissions of many pollutants, even though other studies have demonstrated the opposite. UAI and scientists from Ford, GM, and other organizations have shown the EPAct study and MOVES2014 model to be inaccurate and biased against ethanol.[1] The documents UAI has obtained reveal the source of that bias—the petroleum industry's direct influence on the design of the EPAct study's test fuels.

All of the EPA documents cited in this memo are available at http://bit.ly/2eNNgvz.

EXECUTIVE SUMMARY

EPA's emails reveal that the Agency directly solicited financial contributions and technical input, "especially on the fuel matrix," from CRC.[2] The oil industry had an incentive

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[1] *See* James E. Anderson et al., *Issues with T50 and T90 as Match Criteria for Ethanol-Gasoline Blends*, SAE International, 2014-01-9080, at 1032–33 (Nov. 1, 2014); Thomas L. Darlington et al., *Analysis of EPAct Emission Data Using T70 as an Additional Predictor of PM emissions from Tier 2 Gasoline*, SAE International, 2016-01-0996 (Apr. 5, 2016).

[2] E-mail from John Koupal, Dir., Air Quality and Modeling Ctr., Assessment and Standards Division ("ASD"), Office of Transportation and Air Quality ("OTAQ"), EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RED-000270 (June 7, 2007) ("The CRC members are very eager to provide input to us . . . . I made it clear that . . . we are definitely seeking their input to finalize, especially on the fuel matrix."); *see also* John Koupal & Rick Rykowski, ASD, OTAQ, EPA, EPA Perspective on Fuel Effects Data Needs, Briefing

to participate because, as EPA emphasized, the "[r]esults generated will be critical to future policy decisions," including policies related to "[f]uture [b]iofuel use."[3] CRC executives in turn visited EPA personnel, expressing their "interest in this project and . . . in participating with some additions to the fuel matrix."[4] Two CRC test fuels were ultimately selected by a Chevron employee and added to EPA's matrix.[5] CRC's investment in the design of the EPAct study explains why CRC purchased all of the test vehicles, so EPA could complete testing.[6]

EPA hosted conference calls with oil industry employees "to resolve several outstanding issues related to this fuel matrix."[7] EPA then re-designed the matrix based on their "feedback" and asked several oil industry employees what test fuels they would "prefer to see tested."[8] The oil industry employees responded with detailed input on the test fuel parameters, outlining possible "compromises."[9]

EPA and its oil industry collaborators expected their test fuels to produce bad results for ethanol. When preliminary testing showed that higher ethanol fuels lowered emissions of nitrogen oxide and other pollutants, EPA considered "chang[ing] the program midstream" to

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for CRC Board, EPA-RIF-000775, at -000786 (Sept. 28, 2006) (proposing to use CRC as a clearinghouse to "pool money" and expertise from oil and automobile companies with an interest in the results of the EPAct study); E-mail from Michael Christianson, ASD, OTAQ, EPA, to John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-000344 (Oct. 2, 2007) (discussing CRC support for fuel storage, fuel and oil analysis, and test vehicles).

[3] John Koupal & Rick Rykowski, ASD, OTAQ, EPA, EPA Perspective on Fuel Effects Data Needs, Briefing for CRC Board, EPA-RIF-000775, at -000778.

[4] E-mail from Chris Tennant, Deputy Dir., CRC, to John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-004495 (Apr. 24, 2008).

[5] E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-012841 (Sept. 15, 2008).

[6] EPA, EPAct/V2/E-89: Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles Certified to Tier 2 Standards: Final Report on Program Design and Data Collection 46 (Apr. 2013) (hereinafter EPAct Program Design Report).

[7] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004017 (Feb. 12, 2008).

[8] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Wendy Clark, National Renewable Energy Laboratory ("NREL"), Department of Energy ("DOE"), et al., EPA-RED-000209 (Feb. 19, 2008).

[9] E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008) (stating that EPA had agreed "that whatever fuel matrix is selected, there will be compromises involved.").

obtain different results "[i]f we continue seeing no NO_X effect."[10] In the end, EPA decided to exclude the relevant test fuels from the program,[11] and otherwise altered its slate of test fuels to "emphasiz[e] ethanol effects."[12]

As a result of EPA's changes to the design of its test fuels, to accommodate the oil industry, the statistical robustness of the experimental design decreased from a "G-efficiency" of 83.6% to a G-efficiency of 51.6%.[13] Although EPA at first considered that only a design with G-efficiency above 60% would be satisfactory,[14] the Agency lowered its minimum standard to 50% in response to the deteriorating quality of its design.[15]

EPA's exclusive and secretive reliance on the oil industry to design the EPAct study's test fuels violates the Federal Advisory Committee Act and EPA's own Scientific Integrity Policy and Information Quality Guidelines.

EPA has provided thousands of emails and other internal records to UAI through litigation that Boyden Gray & Associates initiated when EPA failed to timely respond to UAI's FOIA request. But EPA has withheld hundreds of other responsive documents and partially redacted hundreds more. UAI and EPA each recently filed motions for summary judgment asking the U.S. District Court to decide their dispute about the scope of EPA's document production obligation under FOIA.[16] Resolution of this case should uncover even more information about the oil industry's influence over EPA's emissions modeling.

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[10] *See* EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009082 (Sept. 4, 2008).

[11] *See* EPAct/V2/E-89: Final Report on Program Design, App'x A: Re-Design of the Fuel Matrices for EPAct Program, A-2 (Apr. 2013) (showing that EPA decided to drop the three preliminary test fuels) (hereinafter "EPAct Appendix A, Re-Design").

[12] E-mail from Catherine Yanca, to Rich Cook, & Joseph Somers, ASD, OTAQ, EPA, EPA-RED-000537, at -00537–38 (Feb. 24, 2009).

[13] *Compare* EPA, EPAct Light Duty Fuel Effects Program, Experimental Design Proposals, Presentation to CRC, EPA-RIF-000320, at -000325 (Sep. 14, 2007), *with* EPAct Appendix A, Re-Design, *supra* note 11, at A-4.

[14] EPA, Fuel Matrix Design Options, EPA-RED-001086, at -001087 (Jul. 18, 2007) (">60% considered satisfactory").

[15] E-mail from Robert L. Mason, Southwest Research Institute ("SwRI"), to James P. Uihlein, Chevron Products Co., EPA-RIF-012788 (Aug. 27, 2008) ("The value of 50% efficiency is a lower bound by many users on what is acceptable.").

[16] *Urban Air Initiative v. EPA*, No. 15-1333 (D.D.C. filed Oct. 14, 2016).

DISCUSSION

I. EPA's Design of the EPAct Study

A. The Oil Industry Influenced the EPAct Study's Design from the Beginning.

From the outset, EPA modeled the EPAct study's matrix of test fuels on prior studies conducted by the Coordinating Research Council ("CRC"), a group funded by the oil industry.[17] In particular, EPA relied on CRC's E-67 study, a "match-blending" study that found ethanol increases emissions.[18] Like the CRC E-67 study, EPA's original fuel matrix ("Design #0-A"),[19] was limited to fuels with an ethanol content between 0 and 10%, and both the E0 and the E10 test fuels were confined to the same range of values for all the other studied fuel parameters.[20] Design #0-A had three levels of T50,[21] and two levels of T90, RVP, aromatics, and ethanol.[22]

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[17] CRC is funded by the American Petroleum Institute and various automobile companies. *See* CRC, CRC Organizational Overview 8 (June 22, 2015), http://bit.ly/1T2nlfD. Affiliated oil companies include BP, Chevron, ExxonMobil, Aramco, Marathon Petroleum, and Shell. *Id.* at 5.

[18] Thomas Durbin, *Effects of Ethanol and Volatility Parameters on Exhaust Emissions*, CRC Project No. E-67 (2006). The study included three levels of ethanol (E0, E5.7, E10), three T50 temperatures (195°F, 215°F, and 235°F), and three T90 temperatures (295°F, 330°F, and 330°F) in a twelve fuel matrix. *Id.* at 4.

[19] *See* EPAct Appendix A, Re-Design, *supra* note 11. For purposes of this summary, Design #0–A is the 16-fuel matrix that EPA selected prior to the DOE expansion. Design #0-A is available at 2015-11-05, Doc. 8, at 4, and EPA, Expanded EPAct Program, EPA/DOE Collaboration, 2015-11-20, Doc. 2, at 18 (Jan. 8, 2008).

[20] The fuel matrix could therefore be visualized as a cube. *See* EPA, EPAct Light Duty Fuel Effects Program, Experimental Design Proposals, Presentation to CRC, EPA-RIF-000320, at -000324 (Sept. 14, 2007); CRC E-67, *supra* note 18, at 3.

[21] EPA included three T50 levels in order to establish "non-linear effects of T50 on emissions." *See* "Response to Uihlein.doc," EPA-RIF-003014, *attachment to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008). *Cf.* EPAct Program Design Report, *supra* note 6, at 9 ("To capture a non-linear impact, three or more treatment levels of a given parameter must be included in the study design.").

[22] EPA, EPAct Light Duty Fuel Effects Program, Experimental Design Proposals, Presentation to CRC, EPA-RIF-000320, at -000324 (Sept. 14, 2007). For both ethanol levels, the T50 levels were 195°F, 215°F and 235°F; the T90 levels were 300°F to 350°F. EPA, Expanded EPAct Program, EPA/DOE Collaboration, 2015-11-20, Doc. 2, at 18 (Jan. 8, 2008).

While EPA would gradually revise its fuel matrix over several iterations, with input from the oil industry, EPA retained the basic framework of Design #0-A—modeled after CRC's own study—as the base for the EPAct study's ultimate partial factorial design.[23]

EPA's reliance on CRC studies—especially E-67—as a model for the EPAct study is no coincidence; it was the direct result of CRC's significant influence over EPA.[24] EPA invited CRC to "[a]ssist in refining [the] testing proposal,"[25] including through "[a]djustment to the fuel matrix."[26] And EPA proposed that CRC in turn could serve as a clearinghouse to "pool money" and expertise from oil and automobile companies with an interest in the results of the EPAct study.[27]

In its solicitation of funding and expertise from CRC, EPA underscored the importance of the study to CRC's petroleum members by explaining that the "[r]esults generated will be critical to future policy decisions," including those related to "[f]uture biofuel use," which was "expected to grow significantly," eating into the oil industry's market share.[28] Specifically, "the same fuel effects data" would influence

- Annual renewable fuel blending obligations under the Renewable Fuel Standard (RFS),[29]

[23] *See* EPA, Expanded EPAct Program, EPA/DOE Collaboration, 2015-11-20, Doc. 2, at 18 (Jan. 8, 2008).

[24] E-mail from Michael Christianson, ASD, OTAQ, EPA, to Chris Tennant, Deputy Dir., CRC, EPA-RIF-001173, at -001174 (Apr. 17, 2006) ("Following up on my original request for data (thanks again for pointing me in the right direction), I would like to obtain a few pieces of information specific to the CRC-E67 report.").

[25] John Koupal & Rick Rykowski, ASD, OTAQ, EPA, EPA Perspective on Fuel Effects Data Needs, Briefing for CRC Board, EPA-RIF-000775, at -000788 (Sept. 28, 2006).

[26] *Id.* at -000785.

[27] *Id.* at -000788; *see also* EPA, EPAct Data Needs-Proposal, Briefing for CRC, EPA-RIF-002386, at -002404 (Aug. 9, 2006) (presenting to the CRC emissions committee several EPAct program proposals, ranging from $98,000,000 to $10,000,000, and asking at "what level, does CRC and its members want to participate?"); E-mail from Michael Christianson, ASD, OTAQ, EPA, to John Koupal Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-000344 (Oct. 2, 2007) (discussing CRC support for fuel storage, test vehicles, and fuel and oil analysis).

[28] John Koupal & Rick Rykowski, ASD, OTAQ, EPA, EPA Perspective on Fuel Effects Data Needs, Briefing for CRC Board, EPA-RIF-000775, at -000778.

[29] *Id.* at -000776, -000793.

- efforts by EPA or the States to limit or expand the number of "boutique" fuels sold in the States,[30]
- "[p]otential state requests to rescind the ethanol RVP waiver,"[31]
- "State biofuel mandates,"[32]
- State implementation plans ("SIPs") for compliance with air quality standards,[33]
- EPA's Anti-Backsliding Analysis of the RFS,[34] and by extension
- EPA's regulations of mobile source air toxics ("MSAT"), and
- The potential "removal" of the "[o]xy[genate] mandate."

Such policies would depend on the air quality "impacts of fuel changes on emissions," including "[e]thanol—and its impact on T50, T90, [o]lefins, etc."[35] Without CRC's assistance on a new study, EPA said it had "no technical basis for providing" the "legislative and administrative recommendations" required of it.[36]

As a result of EPA's outreach, CRC played a critical role in the EPAct study's design. EPA's staff looked to CRC members to suggest "possible tweaks" in the design of the EPAct study's fuel matrix.[37] John Koupal, Director of Air Quality and Modeling at EPA, personally assured CRC members that EPA would "definitely" be "seeking their input to finalize, especially on the fuel matrix."[38] Rafal Sobotowski, EPA's project manager for the EPAct

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[30] *Id.* at -000776, -000790, -000791, -000792.

[31] *Id.* at -000791.

[32] *Id.*

[33] *Id.*

[34] *Id.* at -000776, -000792 (The anti-backsliding analysis will "serve as the basis for future fuel decisions by legislators and policy makers.").

[35] *Id.* at -000790.

[36] *Id.*

[37] E-mail from Aron Butler, ASD, OTAQ, EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RIF-000456 (June 4, 2007) ("I know we are all looking forward to some feedback from CRC folks for possible tweaks, and thus this should be considered tentative.").

[38] E-mail from John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RED-000270 (June 7, 2007) ("The CRC members are very eager to provide input to us . . . . I made it clear that . . . we are

study, praised Lew Gibbs, a CRC consultant employed by Chevron, for his help in designing the EPAct study.[39] EPA's staff insisted on designing the EPAct study to "complement" existing or pending CRC studies.[40] More than playing an advisory role, CRC was EPA's joint partner in a multi-study scientific venture.[41]

B. Higher Ethanol Content Prompted More Oil Industry Intervention.

EPA was initially unable to secure CRC funding for additional fuel testing, so EPA turned to the Department of Energy ("DOE") for money.[42] Through Wendy Clark, a scientist at DOE's National Renewable Energy Laboratory ("NREL") and former BP employee,[43] EPA secured over $2 million in DOE funds for additional test fuels and particulate matter ("PM") testing in December 2007.[44]

DOE's money came with strings attached. EPA had to re-design its fuel matrix to include higher ethanol blends—E20 and E15—only weeks before fuel blending was scheduled

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definitely seeking their input to finalize, especially on the fuel matrix."). EPA sought CRC input primarily because EPA did not know which fuels in its proposed matrix could be feasibly blended. EPA, EPA's Gasoline Fuel Effects Testing Plans, Presentation to CRC Real World Grp., EPA-RIF-000822, -000824 (June 6, 2007) ("Would like CRC input, esp. on fuel matrix, i.e., Can all the fuels on the matrix be blended?").

[39] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Lew Gibbs, Chevron Fellow, Senior Consulting Engineer, Chevron Products Co., EPA-RIF-002256 (Sept. 12, 2007) ("I truly appreciate your feedback. It has been very helpful to the design of the EPAct program.").

[40] EPA, EPA's Gasoline Fuel Effects Testing Plans, Presentation to CRC Real World Grp., EPA-RIF-000822, at -000824 (June 6, 2007).

[41] *See*, *e.g.*, E-mail from John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-000403, at -000406 (Apr. 4, 2008) ("Chris Tennant and Brent Bailey of CRC would like to visit the lab next week to coordinate on our various projects, including E-69, E-70, E-77, ACES, and our EPAct work (missing anything?).").

[42] *See* E-mail from Joseph Somers, ASD, OTAQ, EPA, to Michael Christianson, ASD, OTAQ, EPA, et al., EPA-RIF-004517 (Dec. 25, 2007).

[43] Wendy Clark was "a great champion of DOE's involvement in the EPAct program." E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Joseph Somers, ASD, OTAQ, EPA, EPA-RIF-004518 (Dec. 5, 2007). Wendy Clark worked at BP for sixteen years before joining NREL. *See* Alternative Energy for the Future, SAE, at http://bit.ly/24iFC0x.

[44] E-mail from Joseph Somers, ASD, OTAQ, EPA, to Kathryn Sargeant, Deputy Dir., ASD, OTAQ, EPA, et al., 2015-11-20, Doc. 2, at 1 (Jan. 8, 2008). On top of the $2 million in initial funds, DOE later secured almost an additional $1 million in funds for EPAct testing. *See* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Paul Machiele, Director, Fuels Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-000407 (May 13, 2008).

to begin. Instead of re-assessing the original matrix, EPA initially decided to add an additional "DOE" fuel matrix on-top of its previous design, without changing the original set of fuels.[45]

The EPAct study's expansion to include higher ethanol blends generated renewed interest from stakeholders in the oil and automobile industries. On February 13, 2008, the Alliance of Automobile Manufacturers ("Auto Alliance") visited EPA's Office of Transportation and Air Quality ("OTAQ") in Ann Arbor and showed Rafal Sobotowski that a lower T50 of 150°F for the E10 and E15 blends was "well-justified" by recent survey data.[46] EPA therefore promised the Auto Alliance to re-design the matrix to include a lower T50 level.[47] This required raising the high RVP level from 9 psi to 10 psi for the entire fuel matrix.[48]

Bob Mason, a statistician for EPA's contractor, Southwest Research Institute ("SwRI"), re-designed the matrices, increasing the RVP level and adding a new set of test fuels with a T50 level as low as 150°F (Designs #0-C and 0–D).[49] Designs #0-C and 0-D had a G-efficiency of approximately 67%, and included eight E20 fuels, each with a T50 of 160°F, and only one E15 fuel, which had a T50 of 150°F.[50]

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[45] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, EPA-RIF-002320 (Oct. 17, 2007) ("The matrix is designed in such a way that its E0/E10 portion can be treated as a separate entity.").

[46] "Response to Uihlein.doc," EPA-RIF-003014, *attachment to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008) ("The T50 level of 150 F for E10 fuels was agreed upon in the course of discussions between the EPA and [Auto Alliance]. It is well justified by recent survey data which show significant numbers of E10 fuels with T50 at 150F and RVP~=10 psi.").

[47] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Ellen Shapiro, Dir. of Automotive Fuels, Alliance of Auto. Mfrs. & Aron Butler, ASD, OTAQ, EPA-RIF-000377 (Mar. 3, 2008).

[48] EPA, EPAct Light Duty Vehicle Fuel Effects Program, EPA-RIF-000378, -000380 (Mar. 3, 2008); Rafal Sobotowski, ASD, OTAQ, EPA, to Paul Machiele, Dir., Fuels Ctr., ASD, OTAQ, EPA, EPA-RED-000203 (Feb. 4, 2008) (discussing T50 and RVP issues arising in light of the DOE re-design).

[49] E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008); "Sobotowski Version 4b test matrix 2012-08.xls", EPA-RIF-004013, *attachment to* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008).

[50] "Sobotowski Version 4b test matrix 2012-08.xls", EPA-RIF-004013, at -004014–16, *attachment to* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008). For a description of the concept of G-efficiency, see EPAct Appendix A, Re-Design, *supra* note 11, at A-2 ("The efficiency value is a function of the number of points in a design, the number and types of factors in a model, and the maximum standard error for model prediction over the design points. The G-optimality criterion seeks to

EPA wanted to include E15 test fuels with a higher T50 than the 150°F level of Designs 0-C and 0-D.[51] But according to Bob Mason, the optimization program used to generate the fuel matrices would have to be "manipulated" to accept the E15/T50 combinations desired by EPA.[52]

The same day that the Auto Alliance visited EPA, EPA hosted a conference call with BP and Chevron employees "to resolve several outstanding issues related to this fuel matrix" including the "T50 ranges at the different ethanol content levels" and "RVP ranges at ethanol content/T50 combinations selected for the test fuels."[53] Based "on feedback" from that conversation with the oil industry, Bob Mason, the SwRI statistician, designed three new fuel matrices, manipulating the software to force the inclusion of E15 blends with a higher T50 of 190°F alongside the low T50 of 150°F.[54]

Mason's three additional designs were as follows:

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minimize the maximum standard error for prediction over the design points. Since a standard fractional design will have an efficiency of 100%, a large G-efficiency value indicates the design is good.").

[51] *See* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008); E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Robert Mason, SwRI, EPA-RIF-004084 (Feb. 15, 2008); "25-trial matrix 2-14-08.xls", EPA-RIF-004085, *attachment to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Robert Mason, SwRI, EPA-RIF-004084 (Feb. 15, 2008).

[52] E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004012 (Feb. 13, 2008) ("The optimization program either chose a fuel at (150,15) or at (190,15), but not runs could be generated that selected both of these points (since the program determined that both were not needed. If you want both of them in the fuel matrix, let me know and we will try to manipulate the program to accept both of them. One way to possibly do this is to initially add a cubic term for EtOH in the model, which might cause both points to be selected. We could then remove the cubic term, but keep both points and measure the G-efficiency of the result using the quadratic model.")

[53] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004017 (Feb. 12, 2008) ("In order to resolve several outstanding issues related to this fuel matrix, we would like to propose a conference call between fuel experts from EPA, BP, and NREL to discuss" "T50 ranges at the different ethanol content levels" and "RVP ranges at ethanol content/T50 combinations selected for the test fuels."); E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004040 (Feb. 13, 2008) ("The EPAct Fuel Matrix conference will take place today[.]")

[54] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Wendy Clark, NREL, DOE, et al., EPA-RED-000209 (Feb. 19, 2008); E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004087 (Feb. 15, 2008).

- Design #0-E, with a G-efficiency of 65.6%, had five E20 test fuels and four "balanced" E15 test fuels, meaning that each level of any given parameter was represented an equal number of times—two E15 fuels had a T50 of 150°F and two had a T50 of 190°F; two had a high T90 and two had a low T90, two had high aromatics and two had low aromatics;[55]

- Design #0-F, with a G-efficiency of 68.1%, had four balanced E20 fuels, and five E15 fuels—three out of five E15 fuels had a high T50 of 190°F, two had a high T90, and three had high aromatics; and[56]

- Design #0-G, with a G-efficiency of 68.3%, was like Design #0-F in that it had four balanced E20 fuels, and five E15 fuels, but three (instead of two) E15 fuels had a high T90.[57]

To choose among these three new designs, EPA again turned to the oil industry for advice, even asking BP and Chevron employees which of these three designs they would "prefer to see tested" in the EPAct study.[58]

C. EPA Re-designed the Matrix To Address the Oil Industry's Concerns.

Some oil industry employees, however, were unhappy with some of the features of the three matrices (Designs #0-E, 0-F, and 0-G). Sobotowski (himself a former BP employee) had asked Frank Gerry of BP to invite James (Jim) Uihlein, an employee of Chevron Products (and a former BP employee) to participate in the discussion of the fuel matrix.[59] After several

[55] "25-trial matrix 2-14-08.xls", EPA-RIF-004088, *attachment to* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004087 (Feb. 15, 2008). The fuels for this design were balanced for all parameters except for RVP, because EPA determined that an RVP of 10 psi was the only level achievable for an E15 or E10 blend with a T50 of 150°F. E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank Gerry, BP Products, et al., EPA-RIF-004019, -004020 ("You will notice that at T50 level of l50F, the RVP will likely be limited to a narrow range around 10 psi. That range will probably be similar for El5 at T50 of l50F. For El5 at T50 of 190F as well as for E20, we assumed RVP range of 6.65-10 psi.").

[56] "25-trial matrix 2-14-08.xls", EPA-RIF-004088, at -004088–89, *attachment to* E-mail from Robert Mason, SwRI, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-004087 (Feb. 15, 2008).

[57] *See id.* at -004089–90.

[58] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Wendy Clark, NREL, DOE, et al., EPA-RED-000209 (Feb. 19, 2008).

[59] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Frank S. Gerry, BP Products, et al., EPA-RIF-004040 (Feb 13, 2008).

discussions with Sobotowski, Uihlein outlined possible design compromises in an e-mail to EPA and NREL.[60] Uihlein first suggested that EPA should renege on its promise to the Auto Alliance, by raising the low T50 level of all fuels to 160°F, "the lowest feasible E20 level," in order to address his concerns with the misaligned T50 levels of the ethanol blends.[61] Uihlein also suggested that the gap between the T50 and T90 temperatures for some fuels was too extreme (up to 200°F), and not realistic for in-use fuels. In his view, blending these fuels would require "gymnastics" and would result in unrealistic "dumbbell" fuels—which vaporize in disproportionate volumes at extremely high and low temperatures.[62]

To "allay" Jim Uihlein's concern about "dumbbell" fuels, Rafal directed SwRI to re-design the fuel matrix once again, lowering the high T90 level slightly to 340°F.[63] SwRI's re-design resulted in the first two fuel matrices reported by SwRI in its official report:

- Design #1, with a G-efficiency of 72.6%, consisted of the same sixteen E0 and E10 test fuels as Designs #0-E, #0-F, and #0-G, but with a high T90 level of 340°F (instead of 350°F); and[64]

[60] E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008) ("In the interest of documenting the trade-offs involved in selecting the fuels matrix, I've put together the following summary of a discussion between Rafal and myself. The focus was on options short of completely re-doing the matrix. There was agreement that whatever fuel matrix is selected, there will be compromises involved."). Uihlein's e-mail can fairly be read as recommending that Sobotowski rejected the Auto Alliance's proposal, and raise the T50 of E15 blends to 160°F. Chevron and CRC had already demonstrated to EPA that moving the T50 of E20 test fuels below the 160°F level was not possible. *See* "Response to Uihlein.doc," EPA-RIF-003014, *attachment to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008).

[61] E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008).

[62] E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-004133 (Feb. 20, 2008); *see also* E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, et al., EPA-RIF-003001 (Feb. 22, 2008).

[63] *See* "Response to Uihlein.doc," EPA-RIF-003014, *attachment to* E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Rafal Sobotowski, EPA-RIF-003013 (Feb. 24, 2008). The EPAct study's test fuels still retained an extreme difference of 190°F between their T50 and the T90 temperatures. According to recent surveys, not a single fuel has these extreme characteristics. Alliance of Auto. Mfrs., 2014 Summer North American Fuel Survey.

[64] EPAct Appendix A, Re-Design, *supra* note 11, at A-4.

- Design #2, with a G-efficiency of 68.1%, consisted of the sixteen Design #1 test fuels plus nine E15 and E20 test fuels.[65] Design #2 was based on Design #0-F, and included four balanced E20 fuels (two with each level of T90, RVP, and aromatics), and five E15 fuels (three with a T50 of 190°F, and two with a T50 of 150°F).

Given the oil industry's influence over the original design, it is not surprising that the E15 fuels were imbalanced in favor of fuel properties that contribute to emissions:[66] one of the five E15 fuels (fuel #24) had high T50, high aromatics, and high T90, but there was no corresponding E15 fuel with a combination of low T50, low aromatics, and low T90.

D. EPA Re-designed its Fuel Matrix when It Proved Impossible to Blend.

During the summer of 2008, as EPA and its oil industry partners continued to design the test fuel matrix for Phase 3, time and money became overriding considerations for EPA, further damaging the quality of the EPAct study's design.[67] EPA was unable to blend the E15 test fuels to specification, while maintaining a realistic distillation temperature curve.[68] By the end of the summer, following conversations with oil industry experts,[69] EPA recognized that it would be unable to blend the E15 test fuels in bulk.[70] EPA therefore decided to re-design the

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[65] *Id.* at A-6.

[66] Fuels are balanced in a matrix if "each level of a factor occurs an equal number of times with each level of the other factors." Robert L. Mason et al., Statistical Design and Analysis of Experiments with Applications to Engineering and Science, at 252 (2nd ed. 2003).

[67] *Cf. id.* at 120 ("Occasionally efficiency becomes an overriding consideration and the project goals become secondary. If time or budgetary considerations lead to undue restrictions on the factors and levels that can be investigated, the project goals should be reevaluated relative to the available resources. This may lead to a decision to forego experimentation.").

[68] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-012872 (Aug. 8, 2008); E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-000408, at -000409 (May 7, 2008) ("Attempts to alter these distillation curves [in preliminary test fuels] failed.").

[69] E-mail from Rafal Sobotowski ASD, OTAQ, EPA, to Sonia Bain, Analytical Services Supervisor, Refining Analytical and Development, Marathon Petroleum Co., EPA-RED-000744 (Thanking Sonia Bain for putting "the whole [reproducibility] issue in a perspective."). Part of the same e-mail chain, without Mr. Sobotowski's reply, appears unredacted at EPA-RIF-012776 et seq. Reproducibility" is a technical ASTM term that refers to the greater variability that can occur when a sample is tested in different laboratories. Neil Ullman, *What are Repeatability and Reproducibility? Part 2,* ASTM Standardization News (May/June 2009), *available at* http://bit.ly/1VHw3Dw.

[70] E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Doug Lawson, NREL, DOE, EPA-RIF-012872 (Aug. 8, 2008) ("As you know, the blending of the first E15 fuel in the EPAct Program has caused a multitude of problems associated with the effect of ethanol on

Phase 3 fuel matrix once again.[71]

EPA's Design #3 replaced two E20 fuels with two new E20 fuels, and added two additional E20 fuels, for a total of "six E20 fuels (in place of four)."[72] Design #3 also replaced two E15 fuels with two new E15 fuels, and dropped two E15 test fuels, for a total of "three E15 fuels (in place of five)."[73] G-efficiency was nominally raised to 68.7%, but the set of E15 test fuels got worse. They were deeply imbalanced—out of three E15 blends, two had a high T50, two had a high T90, and two had high aromatics—all properties associated with increased emissions.[74]

E. EPA Delegated the Design of the EPAct Study to an Oil Industry Employee.

EPA's re-designs of the test fuel matrix were not over. In April 2008, CRC executives Brent Bailey and Chris Tennant visited OTAQ in Ann Arbor to propose a matrix re-design.[75] CRC proposed adding two fuels with an intermediate T90 level of 325°F, in order to test possible "non-linear" effects of T90 in some of the "extreme" fuels—those with a wide gap between the T50 and T90 distillation temperatures.[76] EPA accepted this proposal, and SwRI

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the shape of the distillation curve. It took us nearly two months to prepare the bulk blend of this fuel from the time the hand blend was approved. Based on this experience and on communications with members of the ASTM Subcommittee D02.08.0A, we have concluded that the EPAct fuel matrix should be redesigned to make it more robust and easier to develop.").

[71] *Id.*

[72] *Id.*

[73] *Id.* at EPA-RIF-012872; *see also* EPAct Appendix A, Re-Design, *supra* note 11, at A-8.

[74] *Id.* at EPA-RIF-012873. The high T50 level for the E15 fuels at this point was 190°F, and the low level was 150°F, making the three-fuel average 177°F. Although this is higher than the average for premium summer E15 fuels, EPA would further increase the E15 average to above 200°F. *See infra*, note 104 and accompanying text.

[75] E-mail from Chris Tennant, Deputy Dir., CRC, to John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, et al., EPA-RIF-004495 (Apr. 24, 2008) ("Many of us have talked individually about our interest in this project and our interest in participating with some additions to the fuel matrix; after Brent and I visited with some of you in Ann Arbor last week, it sounds like we should try and speak collectively very soon.").

[76] James P. Uihlein, Proposed CRC Addition to EPA Fuel Effects Study, CRC Emissions Committee Meeting, EPA-RIF-000411, at 000415–16 (May 22, 2008).

re-designed the matrix accordingly under the supervision of Jim Uihlein from Chevron in late August 2008 (Design #4).[77]

CRC's re-design, Design #4, consisted of 30 fuels (as opposed to 25), including two CRC fuels with a T90 level of 325°F and the preliminary test fuels (which had also had a T90 of 325°F).[78] To pick the two new CRC fuels, SwRI designated several candidates through a complicated, five-step process.[79] Uihlein ultimately selected an E10 and E20 pair of fuels, both with high aromatic content (40%), even though (as he pointed out) a similar pair with balanced aromatic levels (15% and 40%) would have produced identical G-efficiency values.[80]

With CRC's re-design, G-efficiency fell from 68.7% to 64.1%.[81]

F. EPA Abandoned Test Results and Test Fuels that Challenged Its Prior Assumptions About Ethanol's Emissions Effects.

EPA's results driven methodology is evident from its handling of Phase 1 of the EPAct study in the spring and summer of 2008.[82] The Phase 1 pilot program was supposed to test three "representative" blends (one E0, one E10, and one E15 blend, labeled #17, #18, and #19, respectively), to generate data for the 2010 RFS rule.[83] Consistent with historic refinery practices, the aromatics levels of these three test fuels were lowest in the fuel with the most ethanol, and highest in the fuel with no ethanol.[84]

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[77] E-mail from Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, at -012843–44 (Aug. 21, 2008) (proposing a new, complex re-design consisting of 6 steps). *See also* EPAct Appendix A, Re-Design, *supra* note 11, at A-8, A-9.

[78] E-mail from Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, at -012843–44 (Aug. 21, 2008). The fuel pairs generated by the SwRI are available at EPA-RIF-012841.

[79] Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, -012843 (Aug. 27, 2008). SwRI did not add a squared aromatics term because G-efficiency would be too low for such a model. *Id.*

[80] E-mail from James P. Uihlein, Chevron Products Co., to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-012841 (Sept. 15, 2008).

[81] EPAct Appendix A, Re-Design, *supra* note 11, at A-11.

[82] EPA, E0/E10 Results from Phase 1 of EPAct Program Preliminary, EPA-RIF-010696 (June 30, 2008).

[83] EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009069 (Sept. 4, 2008).

[84] *Id.* at -009072.

EPA tested these three fuels in 19 Tier 2 vehicles over the Unified Driving Cycle ("LA92").[85]

The final results for Phase 1 became available in September 2008. They showed that NO_X [nitrogen oxides], "CO [carbon monoxide], HC [hydrocarbons], and PM [particulate matter] all have significant decreases in emissions as ethanol levels increase from E0 to E10."[86]

EPA questioned these results because they went against the Agency's prior assumptions about ethanol's emissions effects, based on CRC's "match-blending" studies.[87] EPA had expected to find that ethanol increased NO_X, because that is what CRC had found.[88]

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[85] EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009069 (Sept. 4, 2008); EPAct Program Design Report, *supra* note 6, at 42–43 (listing the 19 vehicles tested in Phase 1 and 2).

[86] EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009081 (Sept. 4, 2008).

[87] EPA was strongly invested in the results of the CRC studies, which predict that ethanol increases NO_X. EPA assured CRC that the EPAct study's design "compl[e]ments recent and ongoing testing by CRC," including E-67 and E-74b. John Koupal, Dir., Air Quality and Modeling Ctr., ASD, OTAQ, EPA, EPA's Plans for Fuel Effects Testing, FACA MOVES Review Workgroup, EPA-RIF-000335, at -000337 (Sept. 18, 2007). To that end, prior to the preliminary program, EPA's EPAct study staff closely reviewed NO_X and HC emissions data from CRC E-67 and the ongoing E-74b study, and EPA's staff created NMHC and NO_X models for RVP, oxygen content, and olefins as fuel parameters based on EPA's extensive analysis of data from these two studies. *See*, *e.g.*, E-mail from Rafal Sobotowski, ASD, OTAQ, U.S EPA, to George Hoffman, ASD, OTAQ, EPA, EPA-RIF-001402 (June 29, 2007) (asking EPA staff to create a predictive model based on these studies); Michael Christianson, ASD, OTAQ, EPA, Robert L Mason, SwRI, EPA-RIF-001290 (June 27, 2007) (e-mailing extensive plots and data based on CRC E-67 data); Michael Christianson, ASD, OTAQ, EPA, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-1305 (June 27, 2007) (forwarding EPA's analysis of E-74b). EPA also relied on the CRC E-74b and E-67 studies to determine how many vehicles would be required to resolve NO_X and HC emissions for E0, E10, and E20 fuels, because data from these two CRC studies "can be used to estimate ethanol effects on HC and NO_X emissions." E-mail from Rafal Sobotowski, ASD, OTAQ, to Greg Janssen, ASD, OTAQ, EPA-RIF-001911 (Nov. 6, 2007). EPA had access to E-74b data because it was closely involved in the design of E-74b even while it was designing the EPAct study. *See, e.g.*, Chris Tennant, Deputy Dir., CRC, to Michael Christianson, ASD, OTAQ, EPA-RIF-001616 (discussing the latest changes to the E-74b study and asking "[o]n a related topic, if memory serves me accurately you or one of your colleagues was working on a literature review relevant to the overall EPAct data needs discussion.").

[88] *See* E-mail from Ed Nam, Dir., ASD, OTAQ, EPA, to Carl Scarbro, ASD, OTAQ, EPA, EPA-RED-000334 (June 1, 2008) (comparing the results of the Phase 1 E10 fuel (fuel 18), with the results of CRC's E-67 study, which indicated that NO_x emissions should have

Accordingly, when preliminary Phase 1 results contradicted CRC's predictions, EPA considered "chang[ing] the program midstream" "[i]f we continue seeing no NO_X effect."[89] Among other strategies, EPA considered adding test fuels with more matched parameters to generate the desired anti-ethanol results.[90]

Instead, EPA decided to conduct additional Phase 1 testing using the Federal Test Procedure ("FTP")—the same test procedure used by CRC in E-74b and E-67[91]—in order to "magnify cold start impact" for ethanol fuels.[92] And CRC loaned EPA two vehicles thought to be more "sensitive" to ethanol's alleged NO_X effect.[93] Analyzing the preliminary data from

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increased for fuel 18); CRC E-67, *supra* note 18, at vii (finding E10 increased NO_X emissions relative to E0 except at the high T50 levels of 235°F); Sierra Research, *Effects of Vapor Pressure, Oxygen Content, and Temperature on CO Exhaust Emissions*, CRC Report No. E-74b, at 80 (2009) (finding E10 increased NO_X emissions "by approximately 10 percent in all FTP Bags and by larger amounts at higher oxygen contents."); EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009087 (Sept. 4, 2008) (citing the results of CRC E-74b, which indicated an increase in NO_x emissions for Tier 2 vehicles).

[89] EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009082 (Sept. 4, 2008).

[90] *Id.* ("If we continue seeing no NO_X effect, should we . . . [a]dd some tests with fuels that have exactly the same properties except for ethanol[?]").

[91] Michael Christianson, ASD, OTAQ, EPA, to Rafal Sobotowski, ASD, OTAQ, EPA, EPA-RIF-001305 (June 27, 2007) (e-mailing the FTP summary for CRC E-74b); CRC E-67, *supra* note 20, at 11 (explaining that the study used the FTP).

[92] EPA, E0-E10-E15 Results from Phase 1 of EPAct Program, EPA-RIF-009068, at -009082 (Sept. 4, 2008).

[93] *Id.*; After EPA's discussion about whether to "change the program midstream," CRC agreed to loan EPA two Tier 1 vehicles used in the E-74b study for interim FTP testing: A 1999 Honda Accord, and a 2001 Toyota Corolla. Work Plan for Work Assignment 1-09, EP-C-07-028, at ED_000545B 00004543, at -00004, -00005 (Nov. 17, 2008). EPA expected these two CRC vehicles would be more "sensitive" to changes in ethanol content, because they had higher NO_X emissions. *See* "CRC E-74 Weekly Status Report 6.24.07.pdf," EPA-RIF-001319, at -001320, *attachment to* E-mail from Michael Christianson, ASD, OTAQ, EPA, to Rafal Sobotowski ASD, OTAQ, EPA, EPA-RIF-001305 (June 27, 207). For lack of funding however, the two CRC vehicles were not tested prior to Phase 3. *See* EPAct/EISA Test Programs in ASD, 23rd Bi-Weekly Report, EPA-RED-001407, at -001408 (Mar. 12, 2009) (reporting that the two CRC vehicles "will be tested after or during Phase 3 if funding is available.").

interim testing of the E0 and E10 fuels, EPA tentatively concluded that the "test cycle was not (highly) influential on results."[94]

EPA had recently added the Phase 1 test fuels to the EPAct study's Phase 3 matrix in late August 2008.[95] But sometime after the preliminary results for Phase 1 became available in September 2008, EPA decided to drop the Phase 1 test fuels (then labeled #26, #27, and #28) from the Phase 3 fuel matrix.[96]

G. EPA Made Arbitrary, Eleventh-Hour Experimental Design Changes to Control Costs.

The test fuel matrix's G-efficiency fell even further to 51.6%, as EPA made a series of arbitrary changes to control costs.[97] Although EPA at first considered that only a design with G-efficiency above 60% would be satisfactory,[98] EPA later lowered its minimum standard to 50% in response to the deteriorating quality of its design.[99]

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[94] EPA, EPAct Program Update for Chet France, at EPA-RED-001207, at -001213 (Jan. 23, 2008).

[95] EPAct Appendix A, Re-Design, *supra* note 11, at A-11; *see also* E-mail from Robert Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012841, at 012843–44 (Aug. 21, 2008). CRC's August re-design of the EPAct study is explained in more detail above. *See supra*, pp. 14–15.

[96] EPAct Appendix A, Re-Design, *supra* note 11, at A-12 ("Fuels 26, 27 and 28 were removed from the matrix design #4."). A memorandum submitted in support of EPA's Tier 3 rule claims that while EPA's original intent was "to fold the data from" the pilot fuels into the Phase 3 dataset, EPA "decided against it for a number of reasons related to improvements made in vehicle handling and prep procedures . . . as well as . . . concerns related to fuel blending[.]" Aron Butler, ASD, OTAQ, EPA, Data Collected in EPAct Fuel Effects Study Pilot Phases, EPA-HQ-OAR-2011-0135 (Apr. 29, 2013).

[97] This diminished G-efficiency value does not fully capture the diminished objectivity and utility of the EPAct study, because it does not take into account the eleventh hour reduction of test fuels and vehicles due to funding shortfalls or the decision to omit the inaccurate Bag 3 (hot start) results. *See infra* at pp. 18–20. Nor does it account for the radical over-simplification that comes with treating T50 and T90 as representative of all distillation temperatures in a study of ethanol blends or treating all aromatics alike. *See* Anderson, *supra* note 1.

[98] EPA, Fuel Matrix Design Options, EPA-RED-001086, at -001087 (Jul. 18, 2007) (">60% considered satisfactory").

[99] E-mail from Robert L. Mason, SwRI, to James P. Uihlein, Chevron Products Co., EPA-RIF-012788 (Aug. 27, 2008) ("It is useful to have a higher efficiency because that indicates that the design is close to having orthogonal effects. However, the efficiency is connected to the candidate set of fuels being considered so we need to be careful to compare

In November 2008, EPA reduced the maximum aromatic content to 35% in November 2008.[100]

In February 2009, Chet France, the Director of the Assessment and Standards Division at OTAQ, "emphasiz[ed] ethanol effects as a goal of the program."[101] And EPA staff decided that, if it had "whittle down" fuels for hydrocarbon speciation, it should emphasize ethanol and "not worry about T50/T90 effects."[102] As a result, EPA reduced the experiment to 12 fuels for speciated hydrocarbons as part of a "reduced design" that emphasized ethanol.[103]

That month, EPA arbitrarily raised the T50 of the E15 test fuels from 195°F to 220°F.[104] EPA then raised the lower T50 level for the E15 and E20 fuels, to 160 and 165°F respectively.[105] According to SwRI, the changes were necessary in order "match levels achievable with the available blending components,"[106] but EPA's report provided a different (and rather curt) explanation. EPA said it raised the high T50 level for the E15 test fuels after discovering that the "upper T50 limit for E15 fuels was as high as 220°F."[107] In other words,

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efficiencies of designs that used the same candidate set of fuels in their construction. The value of 50% efficiency is a lower bound by many users on what is acceptable. Increased to 64% efficiency is a good return, but probably increasing beyond 80% or 90% is not that great an improvement.").

[100] Appendix 1 to EPAct Fuel Development Protocol_Detailed Test Fuel Specification_Version 9-22-2008.xls., EPA-RIF-000443, *attachment to* E-mail from Rafal Sobotowski, ASD, OTAQ, EPA, to Kevin Whitney, Project Mgr., SwRI, EPA-RIF-000442 (Nov. 12, 2008); EPAct Program Design Report, *supra* note 6, at 16.

[101] E-mail from Catherine Yanca, to Rich Cook, & Joseph Somers, ASD, OTAQ, EPA, EPA-RED-000537, at -000537–38 (Feb. 24, 2009).

[102] E-mail from Rick Cook, ASD, OTAQ, EPA, to Catherine Yanca, EPA-RED-000537 (Feb. 25, 2009).

[103] EPAct Program Design Report, *supra* note 6, at 65; *see also* Proposed Speciation List, EPA-RED-001406 (Mar. 11, 2009); EPAct Program Updated for Chet France, Status and Budget, ED_00545OneDrive_0008106, at 00006 (Mar. 2, 2009) (proposing to reduce the scope of speciation despite the fact that the "data [was] necessary for [air quality] modeling and toxic emission factors.").

[104] Proposed Speciation List, EPA-RED-001406 (Mar. 11, 2009).

[105] SwRI's Re-Design Appendix erroneously indicates that EPA increased the low T50 level for the E15 test fuels to 165°F. EPAct Appendix A, Re-Design, *supra* note 11, at A-8. But EPA's specifications show that it increased the low E15 level to 160°F, not 165°F. EPAct Program Design Report, *supra* note 6, at 16.

[106] EPAct Appendix A, Re-Design, *supra* note 11, at A-8.

[107] EPAct Program Design Report, *supra* note 6, at 16. EPA's decision was likely motivated by cost considerations, not design reasons. By adding lighter-end hydrocarbons,

EPA raised the T50 of higher ethanol fuels as high as it would go after being instructed to "emphasize ethanol effects as a goal of the program."[108]

In any event, EPA's eleventh-hour changes raised the average T50 for the E15 test fuels to 220°F—higher than the average for the E10 test fuels (195°F), even though raising ethanol content naturally lowers the T50 of gasoline in the marketplace.[109] And EPA's changes lowered the G-efficiency of Design #5 to 51.6%,[110] lower than any of the previously proposed matrices and dangerously close to EPA's new "lower bound."[111]

EPA's last-minute changes were not limited to the fuel matrix. EPA also lowered the number of Phase 3 test vehicles to 10 from an initial fleet of 19,[112] eventually increasing the number to 15 vehicles a full thirty-seven weeks after vehicle testing had begun (Phase 3 testing took 60 weeks in total).[113] For speciation, EPA also decided to use only 5 vehicles for Bags 2 and 3, with no replicate tests.[114] And Paul Machiele, the Director of EPA's Fuels Center, directed the EPAct study's test team to begin vehicle testing the fuels as they were available,

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EPA would boil-off the ethanol components in the T40 range, which would make the E15 test fuels easier to blend and measure. *Id.* at 37 (showing how the "knee of distillation" for the EPAct study's E15 test fuels was in the T40 range, in contrast with other test fuels with a knee of distillation in the T50-T60 range).

[108] E-mail from Catherine Yanca, to Rich Cook, & Joseph Somers, ASD, OTAQ, EPA, EPA-RED-000537, at -000537–38 (Feb. 24, 2009). Although these last-minute, arbitrary changes by EPA were not part of a comprehensive re-design effort by SwRI, they are reported in SwRI's EPAct Appendix as Design #5. EPAct Appendix A, Re-Design, *supra* note 11, at A-13.

[109] EPAct Appendix A, Re-Design, *supra* note 11, at A-13.

[110] *Id.*

[111] E-mail from Robert L. Mason, SwRI, to James P. Uihlein, Chevron Products Co. EPA-RIF-012788 (Aug. 28, 2008).

[112] EPA, EPAct Program Updated for Chet France, Status and Budget, EPA-RED-00899, at -00900 (Feb. 19, 200[9*]) (* The initial presentation slide is erroneously dated Feb. 19, 2008, but the presentation occurred on February 19, 2009.). EPA also considered eliminating one or two test fuels to control costs, but this change would have reduced G-efficiency below 50%, "the minimum acceptable limit." *Id.* at -00904 (Feb. 19, 200[9*]) (* The initial presentation slide is erroneously dated Feb. 19, 2008, but the presentation occurred on February 19, 2009.).

[113] *See* EPAct Program Design Report, *supra* note 6, at 51 ("Due to initial funding limitations, only ten vehicles were included in the original Phase 3 test plan. Two additional vehicles were added to the matrix in the 25th week of testing, and three additional vehicles were added in the 37th week of testing.").

[114] *Id.* at 65.

without fully randomizing all the test fuels.[115] EPA began fully randomizing the test fuels only after twelve weeks of testing.[116]

Due to EPA's delays, the vehicle leases expired before EPA could conclude testing. To ensure the EPAct study could reach its (flawed) conclusions, CRC purchased the "test vehicles and made them available to the test program for the remainder of its duration" at no charge to EPA.[117]

EPA continued manipulating the design of the study, even after the results for Phase 3 were in. EPA, for example, omitted results for Bag 3 (hot start) emissions, "as review of results suggests that the models for Bag 3 may be less reliable than those in Bags 1 and 2."[118]

II. Legal Implications of EPA's Reliance on the Oil Industry to Design the EPAct Study

EPA's secret consultation with a group of oil company employees about the test fuel parameters violated the requirement of the Federal Advisory Committee Act and EPA's Scientific Integrity Policy that such committees be balanced,[119] that they be publicly announced[120] and that their meetings be open to the public.[121]

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[115] EPAct bi-weekly updated mtg, EPA-RIF-012086 (Aug. 8, 2008) ("Paul says start w/ whatever handful of fuels we have on 11/1, then re-randomize as new fuels arrive"); EPAct Program Design Report, *supra* note 6, at 50–51 (explaining the EPAct study's incomplete randomization). Randomization "is a procedure whereby factor-level combinations are . . . assigned to a test sequence in such a way that every factor-level combination has an equal chance of being assigned to any experimental unit or position in the test sequence." Mason et al., *supra* note 66, at 142. Randomizing is important because it "affords protection from bias by tending to average the bias effects over all levels of the factors of an experiment." *Id.* at 141.

[116] EPAct Program Design Report, *supra* note 6, at 51.

[117] *Id.* at 46.

[118] EPA, Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles Certified to Tier 2 Standards: Analysis of Data from EPAct Phase 3 (EPAct/V2/E-89), Final Report, at 3 (Apr. 2013).

[119] 5 U.S.C. App'x 2, § 5(b)(2). "The term 'advisory committee' means any committee, board, commission, council, conference, panel, task force, or other similar group, or any subcommittee or other subgroup thereof . . . established or utilized by one or more agencies . . . in the interest of obtaining advice or recommendations for . . . one or more agencies or officers of the Federal Government." *Id.* § 1(2).

[120] *Id.* § 9(a).

[121] *Id.* § 10(a)(1); *accord* EPA, Scientific Integrity Policy 3, *available at* http://bit.ly/2cF7XVR.

EPA's exclusive reliance on oil industry employees with an incentive to generate results favorable to petroleum and disfavorable to ethanol violated the objectivity requirement of the Agency's Information Quality Guidelines.[122] It also violated EPA's Scientific Integrity Policy, which requires all employees, including scientists and managers, to "[a]void conflicts of interest and ensure impartiality."[123]

EPA's reliance on oil industry consultants was kept secret, in violation of the Scientific Integrity Policy's requirement that scientific findings, be "generated and disseminated in a timely and transparent manner."[124]

The EPAct study contributed directly to the emissions factors in EPA's new vehicular emissions model, MOVES2014, which State must use in constructing implementation plans for compliance with EPA's air quality standards. EPA's unlawful reliance on the oil industry to design the EPAct study compounds the agency's failure to give the public notice and an opportunity to comment on the MOVES2014 model, as required by law.[125]

[122] EPA, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency, at 3, 15, 22 (Oct. 2002), *available at* http://www.epa.gov/QUALITY/informationguidelines/documents/EPA_InfoQualityGuidelines.pdf.

[123] EPA, Scientific Integrity Policy 3; *see also id.* ("Welcome differing views and opinion on scientific and technical matters as a legitimate and necessary part of the scientific process.").

[125] 5 U.S.C. § 553(b), (c).