IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF VIRGINIA
CHARLOTTESVILLE DIVISION

CLAUDE DAVID CONVISSER)
)
and)
)
POP DIESEL AFRICA, INC.,)
)
Plaintiffs,)
)
v.)
)
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,)
)
FONTAINE MODIFICATION COMPANY,)
)
GFL ENVIRONMENTAL, INC.,)
)
OPTIMUS TECHNOLOGIES, INC.,)
)
AKTIEBOLAGET VOLVO a/k/a AB VOLVO,)
)
and)
)
VOLVO GROUP NORTH AMERICA, LLC,)
)
Defendants)

CLERK'S OFFICE U.S. DISTRICT COURT
AT CHARLOTTESVILLE, VA
FILED
JAN 20 2026
LAURA A. AUSTIN, CLERK
BY DEPUTY CLERK

Civil Action No. 3:26CV5

COMPLAINT

Plaintiffs Claude David Convisser and POP Diesel Africa, Inc. ("POP Diesel" or "the Company") (together "plaintiffs"), by counsel,[1] state as their complaint under the Clean Air Act, Chapter 85 of Title 42 of the United States Code, 42 U.S.C. sections 7401, *et seq.* ("Clean Air

[1]Counsel has carefully proofread this Complaint before filing it, yet continues to find new typographical errors, spelling and basic grammatical errors, cropping up. Any typos remaining are the result of malicious software he is unable to rid his laptop computer of that gives plaintiffs' business opponents back channel access to his document creation.

Act"), against defendants the United States Environmental Protection Agency ("EPA"), Fontaine Modification Company, GFL Environmental, Inc., Optimus Technologies, Inc., and Aktiebolaget Volvo a/k/a AB Volvo and Volvo Group North America, LLC for allowing light, medium and heavy duty compression ignition (diesel) engines and motor vehicles to operate on biofuel or biodiesel that generates excessive levels of nitrous oxides and sulfur dioxides in breach of emissions standards, and for equipping them to operate and operating them thereon, as follows:

SUBJECT MATTER JURISDICTION

1. Original subject matter jurisdiction in this Court is premised on Title 28 U.S.C. section 1331.

PERSONAL JURISDICTION

2. Defendant the United States Environmental Protection Agency ("EPA") is responsible for administering and enforcing the Clean Air Act across the United States of America ("USA"), including within the geographical jurisdiction of the Charlottesville Division of this Court.

3. As set forth in the section of this Complaint titled "Parties" below, all of the defendants have transacted business within the geographical jurisdiction of this Court, engaged in activities described herein therein, or combined to send their products into it in violation of the Clean Air Act.

VENUE

4. Venue lies properly in this Court pursuant to Title 28 U.S.C. sections 1391(b)(2) and 1391(b)(3).

BIOFUEL AND BIODIESEL

5. "Biofuel" is a generic term that EPA uses to mean any fuel deriving from live plant matter, as compared to fuel coming from fossilized matter. For the purposes of this lawsuit, "biofuel" includes straight vegetable or fruit oil of the kind POP Diesel won EPA approval to sell in 2013; biodiesel which is heavily processed from plant oil or animal fat changing the molecular structure of its triglyceride molecule into fatty acid methyl esters ("FAMEs"); and hydro-processed esters and fatty acids ("HEFAs"), made also by heavily processing triglyceride feedstock by means of hydrogenating it, or combining it with hydrogen atoms.

6. According to a study commissioned by the European Commission, counting the land use changes such as tearing down virgin tropical rainforest in Indonesia to plant palm oil trees, the use of hazardous processing chemicals resulting in hazardous waste, and the high energy input required for its manufacture, biodiesel is worse for the environment than petroleum, which with other fossil fuels, is the primary cause of global warming. http://euractive.com/section/climate-environment/news/biodiesel-worse-for-the-environment-than-fossil-fuels-warn-green-campaigners/.

a. Similarly in Ghana and other tropical locales where POP Diesel seeks to grow the *jatropha curcas* tree for the purpose of generating biofuel, its opponents are destroying virgin tropical forest in a rushed attempt to preempt, displace and negate its project.

b. In the USA, federal support to farmers planting soy, the most common feedstock used to make American biodiesel, is partially responsible for agricultural fertilizer run-off draining into the Mississippi River that contributes oxygen-deprivation and a resulting marine dead zone across a large swath of the Gulf of Mexico/America.

c. On the other hand, there is enough soy grown in the USA that its oil, if used as a substitute for fossil fuel crude petroleum, could account for around seven percent of plastic and petro-chemical production in the USA, which itself comprises one-tenth of all petroleum consumed in this country.

7. In 2022, the last year for which data for both fuels is publicly available, the production volume of biodiesel in the United States was 1.62 billion gallons, or 2.6 percent of the approximately 62 billion gallons of No. 2 petroleum diesel fuel sold for on-road use that year. www.statista.com/statistics/509875/production-volume-of-biodiesel-in-the-us; www.eia.gov/dnav/pet/pet_sum_mkt_dcu_nus_m.htm (both checked 11/2/25 at 10:51 p.m. E.T.). The U.S. Energy Information Administration seems no longer to publish fuel prices after 2011; assuming an average sales price of $3.50 per gallon that year, total sales of biodiesel were approximately $5.7 billion.

PARTIES

8. Plaintiff Claude David Convisser is the Chairman and Chief Executive Officer of plaintiff POP Diesel Africa, Inc., and at present, the sole shareholder in trust for subsistence farmers around the tropical world who will plant the *jatropha curcas* tree for use of its inedible fruit seed oil as fuel to power diesel engines with POP Diesel's EPA-approved, plant oil-enabling equipment installed on them.

9. Liquid Environmental Solutions ("LES") is a Texas corporation with its principal place of business in Texas. It is not a defendant, but plaintiffs intend to join it as such, or seek leave therefore, sometime after the expiration of sixty days following notice sent it of violations of the Clean Air Act, if the provisions of 42 U.S.C. section 7604(b)(1) at that time so authorize.

10. With EPA's condonation made in breach of its non-discretionary duty to regulate biofuel to prevent excessive, hazardous emissions from combustion:

a. LES sells "biofuel" EPA has approved for combustion in diesel engines equipped with an after-market alternative fuel conversion system manufactured by defendant Optimus Technologies, Inc. ("the Optimus kit"). See spreadsheet titled *Conversion systems for outside useful life vehicles or engines*, line 50, at https://www.epa.gov/ve-certification/lists-epa-compliant-alternative-fuel-conversion-systems#outside-useful-life ("EPA OUL conversion approvals").

b. LES's biofuel is derived from brown grease ("brown grease fuel").

c. This brown grease fuel is made by filtering and removing the moisture from grit trap grease that collects in the wastewater drains of restaurants, which restaurant traps LES is in the business of cleaning and collecting from nationwide.

d. Brown grease is distinguished from "yellow grease," which is waste cooking oil from the restaurant fryer that is not washed down the drain.

e. Due to detergent soap that washes down the restaurant drain, brown grease fuel is extremely high in sulfur content, which puts emissions of it when combusted, and of any biodiesel derived from it, in breach of regulatory limits adopted under the Clean Air Act for sulfur dioxides and their derivatives, a formative ingredient of smog pollution.

f. In addition, this brown grease fuel likely comes from cooking oils used in restaurant kitchens, such as the most common plant oil, soy, used therefore, that produce excessive nitrous oxides (NO2) emissions when combusted, nitrogen oxides being another formative ingredient of smog pollution that are subject to EPA regulations adopted pursuant to the Clean Air Act.

g. For the reasons stated in subparagraphs (e) and (f) foregoing, use of this brown grease fuel or any biodiesel derived from it renders diesel trucks and cars equipped after-market to run on this brown grease fuel, or any admixture of biodiesel derived from it and petroleum diesel fuels, in violation of the proscription set forth in 42 U.S.C. section 7522(a)(3) against tampering with original engine equipment emissions-certified by EPA which results in their emissions' becoming non-compliant with the Clean Air Act. 42 U.S.C. § 7522(a)(5).

h. Upon information and belief, LES supplies its brown grease fuel or biodiesel derived from it from its facility in Yorktown, Virginia.

i. LES supplies its brown grease fuel nationwide, or any admixture of biodiesel derived from it and petroleum diesel fuels, to the trucks equipped with the Optimus kit of defendant GFL Environmental, Inc., including those trucks operating within the geographical jurisdiction of this Court.

11. Defendant Fontaine Modification Company ("Fontaine") is a Delaware corporation with its principal place of business in North Carolina that does after-market installation of alternative fuel systems on diesel trucks, among other services it offers to trucking fleets.

a. As of May 30, 2024, Fontaine was installing the Optimus kit on "hundreds of new orders" at its eleven engine modification centers around the USA, according to its website.

b. Upon information and belief, Fontaine installs the Optimus kit at its installation facilities in Dublin, Virginia and Salem, Virginia, both within the geographical jurisdiction of this Court.

12. Defendant GFL Environmental, Inc. ("GFL") is a Canadian corporation with its corporate headquarters in the area of Toronto, Ontario.

a. GFL claims to be the fourth largest diversified environmental services company in North America.

b. GFL has had the Optimus kit installed after-market on some of its solid waste collection trucks for which Optimus kit installation EPA, in breach of its nondiscretionary duty set forth below, gave Optimus approval in 2014.

c. GFL has refuse collection and trucking facilities in Troy, Virginia and Ruckersville, Virginia, from which some of these trucks operate, within the geographical jurisdiction of this Court.

d. GFL has the Optimus kit installed on other of its 7,100+ trucks based at any of its landfills, transfer stations, organic facilities, and waste separation and recycling centers in the United States and Canada. These may include new Volvo and Freightliner models it owns that are part of the Optimus testing exemption program, installed by Fontaine, discussed below.

13. Defendant Optimus Technologies, Inc. is a Pennsylvania corporation with its principal place of business in Pittsburgh.

a. Optimus was the second company, in 2014 after POP Diesel in 2013, to win EPA approval to install and sell after-market equipment, which EPA calls a "clean alternative fuel conversion system," enabling a diesel truck to run on 100 percent plant-based fuel. See EPA OUL conversion approvals, lines 50, 52 and 53 ("Plant Oil Powered [POP] Diesel Fuel Systems, Inc.").

b. Optimus's original 2014 EPA approval was to retrofit trucks having the 2004 model year, 7.6-liter International engines. EPA OUL conversion approvals, line 50.

c. In addition, upon information and belief, EPA has granted Optimus a testing exemption under 42 U.S.C. section 7522(b)(1) to install its alternative fuel conversion system on new, Class 8 Volvo VNR Sleeper and Freightliner Cascadia Sleeper Trucks. https://share.hsforms.com/19.2zJL1n1lT0S00uGDa1PPXAnuumy and www.prnewswire.com/newsr-releases/proven-decarbonization-technology-available-on-new-class-8-trucks-302159788.html ("Optimus News Release" dated May 30, 2024 and checked 11/2/25).

d. Optimus supplies its kit to Fontaine for installation on trucking customers like GFL.

15. Defendants Aktiebolaget Volvo a/k/a AB Volvo, the Swedish parent corporation, and Volvo Group North America, LLC, a Delaware corporation headquartered in North Carolina, own and operate Volvo Trucks in North America (together "Volvo").

a. Volvo sells diesel trucks in the USA, including within the geographical jurisdiction of this Court.

b. Volvo permitted Optimus to secure an emissions testing exemption to install the Optimus kit on one model of its new trucks, the Class 8 Volvo VNR Sleeper, which installations Fontaine are performing.

EPA'S NONDISCRETIONARY DUTIES

16. The Clean Air Act vests in EPA certain non-discretionary duties relevant hereto. These include:

a. Issuing a certificate to a manufacturer of a new motor vehicle or engine for sale or introduction into commerce only if emissions resulting therefrom conform to regulations adopted under 42 U.S.C. section 7521 of the Clean Air Act. 42 U.S.C. § 7525(a).

b. Authorizing conversion of a motor vehicle or engine "for use of a clean alternative fuel" only if "such vehicle complies with the applicable [emissions] standards under [42 U.S.C.] section 7521 [] when operating on such fuel." 42 U.S.C. § 7522(a)(5).

c. Applying "adjustment factors that the Administrator deems appropriate to assure that each vehicle or engine [actually in use] will comply during its useful life with" emissions standards prescribed under 42 U.S.C. section 7521. 42 U.S.C. § 7525(a)(1).

d. For a fuel or fuel additive that EPA has chosen to register pursuant to 42 U.S.C. section 7545(a), requiring the fuel or fuel additive manufacturer "on a regular basis" to test for "the potential public health and environmental effects of the fuel or additive." 42 U.S.C. § 7545(b)(2).

e. Treating biodiesel as "a fuel substitute produced from nonpetroleum renewable resources that meets the registration requirements for fuels and fuel additives [] under section 7545," thereby invoking EPA's nondiscretionary duty set forth in the preceding subparagraph (d). 42 U.S.C. § 13220(f)(1).

f. If EPA determines that a combustion emission has serious, negative "potential public health and environmental effects" or as otherwise dictated by the Clean Air Act: issuing a National Ambient Air Quality Standard, as EPA has done for both nitrous oxides and sulfur dioxides and their derivatives. 42 U.S.C. §§ 7409 and 7545(b)(2).

g. Prescribing combustion emissions standards under 42 U.S.C. section 7521 designed to attain and satisfy the National Ambient Air Quality Standards ("NAAQS").

h. Using EPA's plenary authority under 42 U.S.C. sections 7414, 7521, 7542(a), 7545, and 7601(a) to forbid a fuel that EPA has chosen not to register pursuant to 42

U.S.C. section 7545(a) from being sold and entering commerce that EPA knows exceeds combustion emissions standards designed to attain and satisfy NAAQS.

LEGAL CLAIMS

17. This lawsuit is authorized against EPA by 42 U.S.C. section 7604(a)(2) and against the other defendants by 42 U.S.C. section 7604(a)(1).

18. Pursuant to 42 U.S.C. section 7604(b)(1), plaintiffs, copying the relevant Virginia state authority, provided all defendants with written notice of allegations of their violations of the Clean Air Act longer than sixty days before plaintiffs filed this Complaint. These written notices are attached to this Complaint as Exhibit 1 and are incorporated by reference herein.

19. Particular NO2 emissions standards EPA is facilitating violation of and the five other defendants are alleged below to have violated are stated in the "Final Rule for Phase 1 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles," published September 15, 2011 and applicable starting in model year 2014; "Final Rule for Phase 2 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles," adopted October 25, 2016 and applicable to model years 2018 to 2027; EPA Final Rule "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," adopted December 20, 2022 and applicable to model years 2027 and beyond; and corresponding regulations adopted for nonroad engines and vehicles pursuant to 42 U.S.C. section 7547.

COUNT 1

AGAINST THE U.S. ENVIRONMENTAL PROTECTION AGENCY FOR BREACH OF ITS NON-DISCRETIONARY DUTIES UNDER THE CLEAN AIR ACT

42 U.S.C. § 7604(b)(1)

20. Plaintiffs reiterate paragraphs 1 through 19 above and incorporate them by reference as if restated herein.

Factual Allegations

EPA's Blind Eye Turned towards the Nitrous Oxides Emissions Compliance of Biofuel and Biodiesel Running in Diesel Engines

21. EPA knows that the source plant or animal oil has a significant effect on emissions outcomes from biodiesel. EPA, A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Draft Technical Report, EPA420-P-02-001, October 2002, pages 51-52 (excerpt, Exhibit 2).

a. EPA's statistical analysis of 39 biodiesel emissions studies found that nitrous oxides ("NO2") emissions were, on average and without attribution to any source feedstock, 10 percent higher for B-100 (100 percent) biodiesel than petroleum diesel fuel. David Korotney, EPA Analysis of the Exhaust Emissions Impacts of Biodiesel: Presentation to the Mobile Source Technical Advisory Subcommittee, October 16, 2002 ("EPA Statistical Analysis"), slide 7 (excerpt, Exhibit 3). These biodiesel emissions results were different depending on whether the fuel derived from soybean oil, rapeseed (Canola) oil, or animal fats. EPA Statistical Analysis (Exhibit 3), slides 8 and 13.

b. According to the National Renewable Energy Laboratory of the U.S. Department of Energy ("NREL"), there is a great variability in NO2 emissions, depending on the source content of biodiesel feedstock. Bob McCormick, Effect of Biodiesel on Pollutant

Emissions (for the Biodiesel Utilization Workshop in Boise, Idaho on September 9, 2004), NREL ("NREL Report"), slides 11 and 16 (excerpt, Exhibit 4).

c. The number of double carbon bonds in a biodiesel molecule "can have a large effect on biodiesel properties." NREL Report (Exhibit 4), slide 9.

i. The number of double carbon bonds is measured by reacting them with iodine, giving an Iodine Value. Id.

ii. A higher Iodine Value indicates plant oil or biodiesel that is more highly unsaturated with hydrogen atoms that will, therefore, produce higher NO2 emissions. Id. (Exhibit 4), slides 9-12.

iii. NREL reports NO2 neutrality of a sample of plant oil or biodiesel, meaning no higher or lower NO2 emissions than petroleum diesel fuel, at an Iodine Value of 95. Id. (Exhibit 4), slide 13.

iv. Soy plant oil's Iodine Value is typically greater than 120. Id.

v. Inedible fruit seed oil of the tropical *jatropha curcas* tree that POP Diesel tested had an Iodine Value of 82.2. Intertek Report No. US 621-11262 (Exhibit 5).

vi. Palm oil is a more highly saturated plant oil that will therefore, have a lower Iodine Value. NREL Report (Exhibit 4), slide 10.

vii. Biodiesel processed from animal fat may produce no higher NO2 emissions than petroleum diesel does. NREL Report (Exhibit 4), slide 9.

viii. If biodiesel is processed from waste cooking oil, which accounts for approximately one-ninth of the biodiesel manufactured in the USA, the nitrous oxides emissions could be anywhere on the scale, since waste cooking oil can come from all manner of animal and plant oil feedstock and an infinite variety of mixtures of them. U.S. Energy

Information Administration, *Composition of Feedstock for Annual Production of FAME Biodiesel* (as reported on the farmdocdaily website at the University of Illinois) (Exhibit 9).

d. EPA was and is aware of the NREL report. Exhibit 4.

22. If a sample or batch of biodiesel is uniformly from a particular source feedstock of pure plant oil, the NO2 emissions, and whether they exceed the tipping point Iodine Value of 95, will depend on the source plant of the oil and the proportion of blending of plant oil feedstocks therein.

23. Transesterification of triglyceride / plant oil molecules into biodiesel does not change the number of double carbon bonds.

24. Therefore, the Iodine Value in the source feedstock of biodiesel will be the same as with the final fuel.

25. Therefore, the foregoing evidence of the variability of NO2 emissions will apply to biodiesel processed from a pure plant oil or other triglyceride feedstock, in the same way as they do to the feedstock itself.

EPA's Seminal Failure to Screen for Excessive Nitrous Oxides Emissions from Biodiesel

26. For a fuel that EPA has chosen to register pursuant to 42 U.S.C. 7545(a), EPA regulations prescribe three levels of emissions testing. 42 U.S.C. § 7545(b); 40 C.F.R. §§ 79.1, *et seq.* Tier 1 testing occurs at the outset of the fuel registration process, and Tier 2 and if EPA requires it, Tier 3 testing are follow-on.

27. From the results of Tier 1 testing for biodiesel that the National Biodiesel Board submitted to EPA pursuant to 42 U.S.C. 7545(b) in January 1998, prepared by Christopher A. Sharp of the Automotive Products and Emissions Research Division of the Southwest Research Institute ("SWRI") and approved by its Director Chris T. Hare ("NBB Biodiesel Tier 1 Testing")

(Exhibit 6), it is apparent that EPA failed to ascertain and monitor for the source of feedstock used, to be able to measure the varying results for NO2 according to its source feedstock.

a. This data (Exhibit 6) provided EPA for biodiesel does not identify the source feedstock.

b. However, pursuant to mandatory Tier 1 testing of NO2 emissions under 40 C.F.R. 79.52(b)(2)(i), the single source of neat biodiesel used therefore produced Transient NO2 Emissions that were 10 percent higher than when the same test engine was running on No. 2 petroleum diesel fuel, on average 5.17 versus 4.57 g/hp-hr. NBB Biodiesel Tier 1 Testing (Exhibit 6), page 9, Table 3.

28. Tier 2 data on biodiesel prepared by Lovelace Respiratory Research Institute dated May 22, 2000 that the National Biodiesel Board submitted to EPA pursuant to 42 U.S.C. 7545(b) identified the biodiesel feedstock tested as soy, but tested and measured NO2 emissions according to health standards (parts per million), rather than emissions standards (grams per horsepower-hour) promulgated under 42 U.S.C. 7521. Excerpt, Exhibit 7, at 3 of Executive Summary and at 32 of Final Report.

29. Therefore, the sole data that EPA had before it measuring biodiesel's compliance with the mandate stated at 42 U.S.C. 13220(f)(1) to satisfy the registration requirements of 42 U.S.C. 7545 showed NO2 emissions of nondescript neat biodiesel to be 10 percent higher than petroleum diesel fuel's.

EPA's Continuing, Willful Violation of Its Nondiscretionary Statutory Duty to Constrain NO2 Emissions from 100 Percent Biodiesel or "Biofuel"

30. Ten years after in 1998 EPA gave the National Biodiesel Board a pass on its Tier 1-reported excessive NO2 emissions, and several years after EPA's and NREL's own studies reported above that the source feedstock of biodiesel was determinative of NO2 emissions, in

June 2008, Nextfuels submitted to EPA fresh Tier 1 data for its biodiesel, again with testing done by SWRI ("Nextfuels' Biodiesel Tier 1 Testing") (excerpt, Exhibit 8).

31. Nextfuels' Biodiesel Tier 1 Testing utilized biodiesel made from palm oil, which because of its high hydrogen saturation, produced NO2 emissions no worse than petroleum diesel fuel's. Nextfuels' Biodiesel Tier 1 Testing (Exhibit 8), at vii and 19.

32. By that time, EPA knew that palm oil was not representative of the vast bulk of biodiesel on the American market coming from unsaturated plant oil and fat sources that would produce higher NO2 emissions than petroleum diesel fuel and thereby, violate emissions standards. Exhibit 9.

33. EPA failed to act on the confirmation in Nextfuels' Biodiesel Tier 1 Testing (Exhibit 8) of its own Statistical Analysis showing that while biodiesel typically produced 10 percent higher NO2 emissions than petroleum diesel fuel, emissions results varied by feedstock source. Exhibit 3, slides 7, 8 and 13.

34. As a result, with a green light from EPA's willful disregard of its oversight responsibility, Nextfuels was free then to manufacture biodiesel from the most widely available feedstocks in the United States, soy oil and waste yellow grease, which produce significantly higher NO2 emissions than petroleum diesel fuel and render an engine noncompliant with emissions standards, just as other biodiesel manufacturers reliant on the National Biodiesel Board's original Tier 1 and 2 testing noncompliant with NO2 emissions standards were doing.

EPA's Concealment in Defiance of Its Nondiscretionary Statutory Duty to Constrain NO2 Emissions from 100 Percent Biodiesel or Generic Biofuel

35. When POP Diesel brought the foregoing topic to EPA's attention informally in August 2014, specifically the need to test, measure and report the Iodine Value of the biodiesel or biofuel or its feedstock source as a surrogate for nitrous oxides emissions, EPA officials

pointed the finger at each other and then banned further communications with him on this subject.

a. First, on August 4, 2014, Dr. Fakhri J. Hamady, Technical Advisor on Engines in the Ann Arbor, Michigan Compliance Division of EPA's Office of Transportation & Air Quality ("OTAQ"), directed POP Diesel to Jim Caldwell of EPA's Fuel Compliance Center.

b. Then on August 7, 2014, Jim Caldwell responded, "[T]his is an issue for the engine folks in Ann Arbor. I deal with fuel composition and rely on the experts in Ann Arbor with respect to an engine's emissions performance."

c. When Claude Convisser sought a teleconference with these and related EPA staff to try to see if everyone was on the same page, on August 13, 2014, Justin G. Greuel, Director of EPA's Diesel Engine Compliance Center, responded in writing, noting that he was copying the Director of the Fuels Compliance Center, Mr. John Weihrauch, and the Director of the Light-Duty Vehicle Center, Mr. Linc Wehrly:

> [Your] topic[] do[es] not fall within our Centers' area of expertise or authority. Given the significant workload in front of our teams with implementing current regulatory programs, we respectfully decline your meeting request. Similarly, we are directing our staff not to respond to other questions on this matter.

36. While the information stated above in EPA and NREL documents may have come to EPA after the National Biodiesel Board on behalf of biodiesel fuel manufacturers submitted their Tier 1 emissions performance admitting worse NO2 emissions than petroleum diesel fuel, even counting the excessive NO2 emissions stated therein as a one-off aberration, they put EPA on inquiry notice.

a. EPA's nondiscretionary duty pursuant to 42 U.S.C. 7545(b) "on a regular basis" to test or require manufacturers of biodiesel to test for NO2 emissions is inescapable.

b. The reference in the definition of "biodiesel" stated in 42 U.S.C. 13220(f)(1) to "meet[ing] the registration requirements for fuels and fuel additives [] under section 7545[(b)]" must be given some meaning.

c. If EPA contends that a one-time submission of Tier 1 data pursuant to 40 C.F.R. 79.52(b)(2)(i) at the beginning of a fuel's use and introduction to the market, a submission that showed noncompliance, no less, followed ten years later by testing solely on palm oil biodiesel known to produce extraordinary favorable NO2 emissions results, suffices to satisfy EPA's nondiscretionary statutory duty "on a regular basis" to test or require testing under 42 U.S.C. 7545(b), then EPA by its own knowledge and come 2014, its concealment of its knowledge, demonstrated awareness of its breach thereof, rendering engine and motor vehicle certificates and approvals granted thereon void *ab initio*.

Elements of Law

37. The requirement for fuel testing stated in 42 U.S.C. section 7545(b), as applied by 42 U.S.C. section 13220(f)(1) to biodiesel, is rendered meaningless if the sole data before EPA was of a biodiesel fuel that produced worse NO2 emissions than petroleum diesel fuel, and EPA ignored this fact in order to give approval to the National Biodiesel Board's Tier 1 testing.

a. In other words, EPA failed in its nondiscretionary duty by allowing biodiesel for sale which it knew from the very beginning would produce worse NO2 emissions than baseline petroleum diesel fuel.

b. Since emissions standards have got progressively more demanding and restrictive over the years leading to 2025, and EPA planned for them to get tighter, EPA would have known that "worse than petroleum diesel" would mean biodiesel's causing engines and motor vehicles to exceed and violate emissions standards.

38. The Clean Air Act grants EPA plenary legal authority to regulate fuel content, characteristics and measurements, as they relate to combustion emissions, and to require the collection and storage of data. 42 U.S.C. 7414, 7521, 7542(a), 7545, and 7601(a) (identified in the Final Rule published at 85 Fed. Reg. 78412, at 78465 (Dec. 4, 2020), as authority underlying part 80, Registration of Fuels and Fuel Additives, of Title 40 of the Code of Federal Regulations).

39. However, EPA generally has deferred to fuel standards and test specifications developed by the private, non-profit organization ASTM International's Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants ("ASTM's Petroleum Products Committee").

a. See, e.g., Virginia Code section 59.1-167.1 (referring to the Uniform Fuels and Automotive Lubricants Regulation published by the National Institute of Standards and Technology in Handbook 130, which incorporates by reference ASTM fuel standards).

b. Yet ASTM's Petroleum Products Committee does not consider emissions to be an element of a fuel's performance, and is in the process of, or has already completed, removing all emissions-centric characteristics and test measurements, such as for aromatics, from its foundational standard for petroleum diesel fuel adopted by reference in most states' law, ASTM D-975 Standard Specification for Diesel Fuel.

40. Nonetheless, EPA has exercised its plenary authority to require fuel testing in the past. For instance, EPA requires fuel manufacturers to measure the aromatic content of petroleum diesel fuel at the point of manufacture, for sole use in determining the legality of the fuel's volatile organic compounds and particulate matter emissions for sale of the fuel on the market. 40 C.F.R. 1090.1350(b)(2).

41. There is no reason pertaining to, or excuse from, EPA's nondiscretionary duties why the Agency cannot, did not, and does not also mandate measurement of the biodiesel, or its feedstock's, Iodine Value as a predictor of emissions-compliant NO2.

42. There is no reason pertaining to, or excuse from, EPA's nondiscretionary duties why the Agency cannot, did not, and does not also mandate measurement of a generic biofuel's Iodine Value as a predictor of emissions-compliant NO2, which generic biofuel EPA permits also in breach of its nondiscretionary duty to be run in diesel engines bearing the alternative fuel conversion system developed and sold by Optimus.

43. EPA's differential treatment of POP Diesel is curious as it pertains to this topic. It was the first, in 2013, to seek approval from EPA to run select, outside-useful life engines alternatively on No. 2 petroleum diesel fuel and 100 % plant-based fuel. After POP Diesel twice passing laboratory emissions testing, the two United States Senators from the state where the Company then had its headquarters had to intervene to inquire why EPA had not issued its approval and prompt it to so issue.

a. Initially, EPA gave POP Diesel approval to run these engines on nondescript plant oil.

b. However, then Steve DeBord of EPA's Transportation and Air Quality Compliance Division, Diesel Engine Compliance Center, limited this approval to solely the kind of plant oil the Company had tested with, inedible fruit seed oil of the *jatropha curcas* tree.

c. This limitation of EPA's approval to the source of plant oil feedstock, *jatopha*, that POP Diesel had tested with was correct by the law and the fact of emissions variability according the particular source feedstock.

d. However, EPA has failed to adopt the same approach with the copycat business model of Optimus that promotes the use of generic biofuel, which as LES has shown, can be waste material that grossly breaches emissions standards, or biodiesel heavily processed from plant oil, instead of the inexpensive, pure plant oil to which POP Diesel is dedicated.

44. In violation of its nondiscretionary duty under 42 U.S.C. 7545(a) and (b), EPA fails to test, or to require biodiesel and diesel biofuel manufacturers "on a regular basis" to test for, and comply with, nitrous oxides and sulfur dioxides vehicle emissions standards, when it knows that the Tier 1 and Tier 2 testing results with regards to nitrous oxides and sulfur dioxides are inapposite or vacuous. 42 U.S.C. § 7545(b)(2).

45. EPA violates its other nondiscretionary duties stated herein by permitting biodiesel and generic biofuel to run in diesel engines that it knows produce combustion emissions that do not comply with regulations adopted pursuant to 42 U.S.C. section 7521, as follows:

a. EPA issues certificates or verifications to a manufacturer of a new motor vehicle or engine for sale or introduction into commerce knowing that emissions resulting therefrom when the engine is running on biodiesel or generic biofuel will not conform to regulations adopted under 42 U.S.C. section 7521 of the Clean Air Act. 42 U.S.C. § 7525(a).

b. EPA authorizes conversion of motor vehicles or engines "for use of a clean alternative fuel" knowing that "such vehicle [will not] compl[y] with the applicable [emissions] standards under [42 U.S.C.] section 7521 [] when operating on such fuel." 42 U.S.C. § 7522(a)(5).

c. EPA fails to apply and enforce "adjustment factors that the Administrator deems appropriate to assure that each vehicle or engine [actually in use] will comply during its

useful life with" emissions standards prescribed under 42 U.S.C. section 7521. 42 U.S.C. § 7525(a)(1).

d. For its failure to satisfy its nondiscretionary duty to require testing "on a regular basis" that is not inapposite or vacuous, EPA fails to treat biodiesel as "a fuel substitute produced from nonpetroleum renewable resources that meets the registration requirements for fuels and fuel additives [] under section 7545." 42 U.S.C. § 13220(f)(1).

e. EPA defies its nondiscretionary duty to authorize only a fuel, a fuel additive, and original and after-market engine equipment that satisfy emissions standards for nitrous oxides and sulfur dioxides and do not contribute excessively, beyond regulatory standards, to the "potential public health and environmental effects" which the National Ambient Air Quality Standards therefore are intended to mitigate. 42 U.S.C. §§ 7409 and 7545(b)(2).

f. EPA fails to use its plenary authority under 42 U.S.C. sections 7414, 7521, 7542(a), 7545, and 7601(a) to satisfy its nondiscretionary duty to forbid biodiesel and generic biofuel that EPA has chosen not to register pursuant to 42 U.S.C. section 7545(a) from being sold and entering commerce, when EPA knows such fuel causes engines to exceed combustion emissions standards designed to attain and satisfy NAAQS.

46. For its foregoing breaches of non-discretionary duty, EPA is liable to be subject to appropriate temporary, preliminary, and final injunctive relief.

COUNT 2

AGAINST FONTAINE MODIFICATION COMPANY, OPTIMUS TECHNOLOGIES, INC., GFL ENVIRONMENTAL, INC., AND AKTIEBOLAGET VOLVO A/K/A AB VOLVO AND VOLVO GROUP NORTH AMERICA, LLC FOR TAMPERING WITH ORIGINAL ENGINE EQUIPMENT BY INSTALLATION OF AN ALTERNATIVE FUEL CONVERSION SYSTEM ON ENGINES IN ACTUAL USE THAT 42 U.S.C. SECTION 7522(a)(3) PROHIBITS FOR THEIR FAILURE TO COMPLY WITH THE APPLICABLE NITROUS OXIDES AND SULFUR DIOXIDES STANDARDS PROMULGATED UNDER 42 U.S.C. SECTION 7521

47. Plaintiffs reiterate paragraphs 1 through 46 above and incorporate them by reference as if restated herein.

48. Because defendants Fontaine, GFL, Optimus and Volvo participate in installing the Optimus kit on diesel engines after-market or in actual use knowing that these engines will run on biodiesel or generic biofuel that fails to meet emissions requirements under 42 U.S.C. section 7521, these defendants:

a. do not have "the purpose of [] convert[ing such] motor vehicle for use of a clean alternative fuel" as defined in the Clean Air Act, 42 U.S.C. § 7522(a)(5), and;

b. such motor vehicles, "when operating on such fuel," fail to comply with the applicable standard under 42 U.S.C. section 7521. 42 U.S.C. § 7522(a)(5).

49. Therefore, the acts complained of by these defendants are prohibited by 42 U.S.C. section 7522(a)(3).

50. As a result, each of the defendants named in this Count 2 is subject to the civil penalties set forth at 42 U.S.C. section 7524(a) of $2,500 or $25,000 per engine, motor vehicle, part or component, as the case may be.

51. Optimus states on its website that it "has established trusted partnerships with OEMs, modification centers, and national refueling providers." Therefore, it is in a position to

provide information as to others contributing to breaches of the same standards, limitations or orders it is violating.

52. These defendants are subject to appropriate temporary, preliminary and final injunctive relief.

COUNT 3

AGAINST FONTAINE MODIFICATION COMPANY, OPTIMUS TECHNOLOGIES, INC., AND AKTIEBOLAGET VOLVO a/k/a AB VOLVO AND VOLVO GROUP NORTH AMERICA, LLC FOR SELLING OR INTRODUCING INTO COMMERCE NEW MOTOR VEHICLES AND ENGINES THAT ARE NOT AND CANNOT PRESENTLY BE COVERED BY AN EPA CERTIFICATE OF CONFORMITY ISSUED UNDER REGULATIONS PRESCRIBED UNDER THE CLEAN AIR ACT

42 U.S.C. § 7522(a)(1)

53. Plaintiffs reiterate paragraphs 1 through 52 above and incorporate them by reference as if restated herein.

54. Defendants Optimus, Fontaine and Volvo participate in installing the Optimus kit on new Volvo and Freightliner diesel engines knowing, for failure to track its or its source feedstock's Iodine Value, that these engines will run on biodiesel or generic biofuel that fails to meet emissions requirements under 42 U.S.C. section 7521.

55. Without regulating the Iodine Value of the source feedstock for biodiesel or generic biofuel, EPA cannot and could not issue any certificate of conformity to the engine or motor vehicle manufacturer pursuant to 42 U.S.C. section 7522(a)(1) following the termination of such testing exemption that would assure compliance with nitrous oxides and sulfur dioxides emissions standards.

56. Therefore, any testing exemption EPA has given these defendants pursuant to 42 U.S.C. section 7522(b)(1) is illusory, premised on an impossible outcome, and invalid.

57. As a result, each of the defendants named in this Count 3 is subject to the civil penalties set forth at 42 U.S.C. section 7524(a) of $25,000 per engine or motor vehicle.

58. In addition, these defendants are subject to appropriate temporary, preliminary and final injunctive relief.

COUNT 4

AGAINST AKTIEBOLAGET VOLVO a/k/a AB VOLVO AND VOLVO GROUP NORTH AMERICA, LLC FOR SELLING OR INTRODUCING INTO COMMERCE NEW MOTOR VEHICLES AND ENGINES THAT ARE NOT AND CANNOT PRESENTLY BE COVERED BY AN EPA CERTIFICATE OF CONFORMITY ISSUED UNDER REGULATIONS PRESCRIBED UNDER THE CLEAN AIR ACT

42 U.S.C. § 7522(a)(1)

59. Plaintiffs reiterate paragraphs 1 through 58 above and incorporate them by reference as if restated herein.

60. Because defendant Volvo has certificates from EPA for the new diesel trucks and cars it sells and EPA permits these diesel engines to fuel with biodiesel intended to meet the definition of 42 U.S.C. section 42 U.S.C. 13220(f)(1) but failing to do so, these certificates of conformity are invalid, as failing to satisfy regulations promulgated under 42 U.S.C. section 7521(a).

61. Without regulating the Iodine Value of the source feedstock for biodiesel or generic biofuel, EPA cannot and could not issue any certificate of conformity to the engine or motor vehicle manufacturer pursuant to 42 U.S.C. section 7522(a)(1) that would assure compliance with nitrous oxides and sulfur dioxides emissions standards.

63. Any certificate of conformity EPA has given Volvo for such engines are illusory, based on a false premise, and invalid.

62. As a result, Volvo is subject to the civil penalties set forth at 42 U.S.C. section 7524(a) of $25,000 per engine or motor vehicle sold or offered for sale.

62. In addition, Volvo is subject to appropriate temporary, preliminary and final injunctive relief.

PRAYER FOR RELIEF

WHEREFORE, the premises considered, plaintiffs respectfully request the relief pleaded above, plus their reasonable attorney and expert witness fees and costs pursuant to 42 U.S.C. section 7604(d) and such further relief as is just.

Respectfully submitted,

Plaintiffs CLAUDE DAVID CONVISSER
and POP DIESEL AFRICA, INC.,
by counsel

Claude David Convisser,
Attorney at Law
Virginia State Bar No. 33799
P.O. Box 7206
Charlottesville, Virginia 22906
5013 South Louise Ave., # 262
Sioux Falls, South Dakota 57108
Tel. 703-438-0071
cdc@popdiesel.com

JS 44 (Rev. 03/24)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. *(SEE INSTRUCTIONS ON NEXT PAGE OF THIS FORM.)*

I. (a) PLAINTIFFS

Claude David Convisser and POP Diesel Africa, Inc.

(b) County of Residence of First Listed Plaintiff Albemarle County, VA
(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorneys *(Firm Name, Address, and Telephone Number)*
Claude David Convisser
P.O. Box 7206, Charlottesville, Virginia 22906

DEFENDANTS

U.S. Environmental Protection Agency and five corporations listed on a separate page

County of Residence of First Listed Defendant Washington, D.C.
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF LAND INVOLVED.

Attorneys *(If Known)*

II. BASIS OF JURISDICTION *(Place an "X" in One Box Only)*

- ☐ 1 U.S. Government Plaintiff
- ☒ 3 Federal Question *(U.S. Government Not a Party)*
- ☐ 2 U.S. Government Defendant
- ☐ 4 Diversity *(Indicate Citizenship of Parties in Item III)*

III. CITIZENSHIP OF PRINCIPAL PARTIES *(Place an "X" in One Box for Plaintiff and One Box for Defendant)*
(For Diversity Cases Only)

	PTF	DEF		PTF	DEF
Citizen of This State	☐ 1	☐ 1	Incorporated *or* Principal Place of Business In This State	☐ 4	☐ 4
Citizen of Another State	☒ 2	☐ 2	Incorporated *and* Principal Place of Business In Another State	☐ 5	☒ 5
Citizen or Subject of a Foreign Country	☐ 3	☐ 3	Foreign Nation	☐ 6	☐ 6

IV. NATURE OF SUIT *(Place an "X" in One Box Only)*

Click here for: Nature of Suit Code Descriptions.

CONTRACT	TORTS		FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
☐ 110 Insurance	PERSONAL INJURY	PERSONAL INJURY	☐ 625 Drug Related Seizure of Property 21 USC 881	☐ 422 Appeal 28 USC 158	☐ 375 False Claims Act
☐ 120 Marine	☐ 310 Airplane	☐ 365 Personal Injury - Product Liability	☐ 690 Other	☐ 423 Withdrawal 28 USC 157	☐ 376 Qui Tam (31 USC 3729(a))
☐ 130 Miller Act	☐ 315 Airplane Product Liability	☐ 367 Health Care/ Pharmaceutical Personal Injury Product Liability		INTELLECTUAL PROPERTY RIGHTS	☐ 400 State Reapportionment
☐ 140 Negotiable Instrument	☐ 320 Assault, Libel & Slander	☐ 368 Asbestos Personal Injury Product Liability		☐ 820 Copyrights	☐ 410 Antitrust
☐ 150 Recovery of Overpayment & Enforcement of Judgment	☐ 330 Federal Employers' Liability	PERSONAL PROPERTY	LABOR	☐ 830 Patent	☐ 430 Banks and Banking
☐ 151 Medicare Act	☐ 340 Marine	☐ 370 Other Fraud	☐ 710 Fair Labor Standards Act	☐ 835 Patent - Abbreviated New Drug Application	☐ 450 Commerce
☐ 152 Recovery of Defaulted Student Loans (Excludes Veterans)	☐ 345 Marine Product Liability	☐ 371 Truth in Lending	☐ 720 Labor/Management Relations	☐ 840 Trademark	☐ 460 Deportation
☐ 153 Recovery of Overpayment of Veteran's Benefits	☐ 350 Motor Vehicle	☐ 380 Other Personal Property Damage	☐ 740 Railway Labor Act	☐ 880 Defend Trade Secrets Act of 2016	☐ 470 Racketeer Influenced and Corrupt Organizations
☐ 160 Stockholders' Suits	☐ 355 Motor Vehicle Product Liability	☐ 385 Property Damage Product Liability	☐ 751 Family and Medical Leave Act	SOCIAL SECURITY	☐ 480 Consumer Credit (15 USC 1681 or 1692)
☐ 190 Other Contract	☐ 360 Other Personal Injury		☐ 790 Other Labor Litigation	☐ 861 HIA (1395ff)	☐ 485 Telephone Consumer Protection Act
☐ 195 Contract Product Liability	☐ 362 Personal Injury - Medical Malpractice		☐ 791 Employee Retirement Income Security Act	☐ 862 Black Lung (923)	☐ 490 Cable/Sat TV
☐ 196 Franchise				☐ 863 DIWC/DIWW (405(g))	☐ 850 Securities/Commodities/ Exchange
				☐ 864 SSID Title XVI	☒ 890 Other Statutory Actions
				☐ 865 RSI (405(g))	☐ 891 Agricultural Acts
					☐ 893 Environmental Matters
				FEDERAL TAX SUITS	☐ 895 Freedom of Information Act
				☐ 870 Taxes (U.S. Plaintiff or Defendant)	☐ 896 Arbitration
				☐ 871 IRS—Third Party 26 USC 7609	☐ 899 Administrative Procedure Act/Review or Appeal of Agency Decision
			IMMIGRATION		☐ 950 Constitutionality of State Statutes
			☐ 462 Naturalization Application		
			☐ 465 Other Immigration Actions		

REAL PROPERTY	CIVIL RIGHTS	PRISONER PETITIONS
☐ 210 Land Condemnation	☐ 440 Other Civil Rights	Habeas Corpus:
☐ 220 Foreclosure	☐ 441 Voting	☐ 463 Alien Detainee
☐ 230 Rent Lease & Ejectment	☐ 442 Employment	☐ 510 Motions to Vacate Sentence
☐ 240 Torts to Land	☐ 443 Housing/ Accommodations	☐ 530 General
☐ 245 Tort Product Liability	☐ 445 Amer. w/Disabilities - Employment	☐ 535 Death Penalty
☐ 290 All Other Real Property	☐ 446 Amer. w/Disabilities - Other	Other:
	☐ 448 Education	☐ 540 Mandamus & Other
		☐ 550 Civil Rights
		☐ 555 Prison Condition
		☐ 560 Civil Detainee - Conditions of Confinement

V. ORIGIN *(Place an "X" in One Box Only)*

☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from Another District *(specify)* ☐ 6 Multidistrict Litigation - Transfer ☐ 8 Multidistrict Litigation - Direct File

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing *(Do not cite jurisdictional statutes unless diversity)*:
citizens' suit under the Clean Air Act: 42 U.S.C. section 7604(a)

Brief description of cause:
EPA is failing to fulfil its nondiscretionary duty to regulate excess biodiesl emissions, putting engine and fuel manufacturers in breach of the CAA

VII. REQUESTED IN COMPLAINT: ☐ CHECK IF THIS IS A **CLASS ACTION** UNDER RULE 23, F.R.Cv.P. **DEMAND $**

CHECK YES only if demanded in complaint:
JURY DEMAND: ☐ Yes ☒ No

VIII. RELATED CASE(S) IF ANY *(See instructions)*: JUDGE Jasmine H. Yoon DOCKET NUMBER 3:24-cv-72

DATE 1-20-26

SIGNATURE OF ATTORNEY OF RECORD

FOR OFFICE USE ONLY

RECEIPT # AMOUNT APPLYING IFP JUDGE Yoon MAG. JUDGE Memmer

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF VIRGINIA
CHARLOTTESVILLE DIVISION

Listing of All the Defendants

CLAUDE DAVID CONVISSER)
)
and)
)
POP DIESEL AFRICA, INC.,)
)
Plaintiffs,)
)
v.)
)
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,)
)
FONTAINE MODIFICATION COMPANY,)
)
GFL ENVIRONMENTAL, INC.,)
)
OPTIMUS TECHNOLOGIES, INC.,)
)
AKTIEBOLAGET VOLVO a/k/a AB VOLVO,)
)
and)
)
VOLVO GROUP NORTH AMERICA, LLC,)
)
Defendants)

Exhibit 1

Claude David Convisser
Attorney at Law
P.O. Box 7206
Charlottesville, Virginia 22906

cdc@popdiesel.com tel. 703-438-0071

November 15, 2025

Martin Lundstedt
President & Chief Executive Officer
Volvo Group and Volvo Trucks North America
P.O. Box 26115
Greensboro, North Carolina 27402-6115

Re: U.S. Clean Air Act Notice of Violations for Running Biodiesel and "Biofuel" in Your Engines, in Particular the Volvo VNR and Possibly Also Mack Trucks

Dear Mr. Lundstedt:

I write you as the person responsible for Volvo Trucks North America for allowing all Volvo compression ignition vehicles sold in the United States of America, and particularly your VNR Truck and possibly also some models of Mack Truck, to run on biodiesel, by which I mean fatty acid methyl esters, and also generic "biofuel."

The enclosed Notice of Violations dated November 4, 2025 and sent to the U.S. Environmental Protection Agency ("EPA") and four other parties, incorporated by reference herein, gives details. Volvo is mentioned on pages 9 and 10 of that Notice.

Concerning specifically the VNR Truck and possibly also models of Mack Truck, your Company has been participating in an EPA-approved Demonstration Program for running generic "biofuel" and B-100 biodiesel in trucks outfitted with an EPA-approved alternative fuel conversion system developed by Optimus Technologies, Inc. of Pittsburgh, Pennsylvania and installed by Fontaine Modification Company, based in Charlotte, North Carolina. Please find enclosed a 6-page print-out of Fontaine's eleven installation centers around the United States where these installations have been taking place on "hundreds" of Volvo trucks, according to the Optimus website, including two sites in Virginia.

Please do not hesitate to contact me, or have your lawyer contact me, if you would like to discuss further.

Sincerely yours,

Claude David Convisser

Encl's: (1) Notice of CAA Violations sent to EPA; (2) Fontaine Modification Install'n Centers
cc (w/encl's): U.S. EPA Administrator Lee Zeldin; State Authorities

Claude David Convisser
Attorney at Law
P.O. Box 7206
Charlottesville, Virginia 22906

cdc@popdiesel.com tel. 703-438-0071

November 4, 2025

Administrator Lee Zeldin
United States Environmental Protection Agency
William Jefferson Clinton Building
Mail Code: 1101A
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Colin N. Huwyler
President
Optimus Technologies, Inc.
4551 Forbes Ave., Suite 200
Pittsburgh, Pennsylvania 15208

Jamil Young
President
Fontaine Modification Company
8810 Old Dowd Road
Charlotte, North Carolina 28214

Patrick Dovigi
Chief Executive Officer
GFL Environmental, Inc.
100 New Park Place, Suite 500
Vaughan, Ontario, Canada L4K OJ3

Jed R. Mandel
Executive Director
Engine Manufacturers Association
333 West Wacker Drive, Suite 810
Chicago, Illinois 60606

Re: Clean Air Act Notice of Violations pursuant to 42 U.S.C. 7604(b)(1) against **(1)** GFL Environmental, Inc., Fontaine Modification Company, and Optimus Technologies, Inc. for Tampering with Original Engine Manufacturer Emissions and Engine Equipment in Breach of 42 U.S.C. 7522(a) (Motor Vehicles) and Possibly 42 U.S.C. 7547(d) (Nonroad Engines and Vehicles) by **(a)** Installing an Alternative Fuel Conversion System That Fails Its Engine to Utilize Biofuel Meeting EPA Emissions Standards for Nitrous Oxides in Heavy Duty Engines in Breach of 42 U.S.C. 7521 and **(b)** Fueling Diesel Engines with Such Noncompliant "Biofuel" and Biodiesel In Further Breach of 42 U.S.C. 7521; and pursuant to 42 U.S.C. 7604(b)(2), against **(2)** EPA for the Agency's Failure to Fulfill Its Nondiscretionary Duties **(a)** under 42 U.S.C. 7525 to **(i)** Test and Regulate Light and Heavy Duty Compression Ignition Engines and Alternative Fuel Conversion Systems Running on Biofuel or Biodiesel in Such Fuel's Neat Form or When Blended with No. 2 Petroleum Diesel Fuel, in the Only Way to Assure Compliance with Nitrous Oxide Emissions Standards, Which Is by Feedstock Source, and **(ii)** Issue Certificates of Conformity Therefore Only If Such Engines Meet Nitrous Oxides Emissions Standards Issued pursuant to 42 U.S.C. 7521 and **(b)** to Regulate Nitrous Oxide Emissions Resulting from Engine Combustion of **(i)** "Biofuel" Running in the Alternative Fuel Conversion System EPA Approved of Optimus Technologies, Inc. and **(ii)** Biodiesel for, in Breach of

42 U.S.C. 13220(f)(1) Incorporating by Reference 42 U.S.C. 7545(b), Failing on a Regular Basis to Test, or to Require Manufacturers of **(A)** Biodiesel for Use in Light and Heavy Duty Compression Ignition Engines and **(B)** "Biofuel" for Use in Alternative Fuel Conversions to Conduct Tests, to Assure Compliance with Nitrous Oxides Standards under 42 U.S.C. 7521 (and for EPA's failure 2(b), intending to join the Engine Manufacturers Association as a party in interest)

Dear Administrator Zeldin and Mssrs Huwyler, Young, Dovigi and Mandel:

I am the General Counsel and Chief Executive Officer of Plant Oil Powered (POP) Diesel Africa, Inc. ("POP Diesel"), which has become aware of seeming violations of the Clean Air Act and its associated federal regulations pursuant to 42 U.S.C. 7604(a) and (b) by the above parties.

These breaches potentially subject the three heavy duty engine and trucking companies identified above involved in installations of Optimus Technology, Inc.'s alternative fuel conversion system to civil penalties set forth in 42 U.S.C. 7524(a). These breaches may also subject individual members of the Engine Manufacturers Association ("EMA") to such penalties, although POP Diesel does not provide notice to any EMA member of such violation at this time.

Statutory Framework

As you all know, nitrous oxides and their derivatives ("NO2") are a criteria pollutant for which the U.S. Environmental Protection Agency ("EPA" or "the Agency") determined serious, negative "potential public health and environmental effects," 42 U.S.C. 7545(b)(2), and therefore, issued National Ambient Air Quality Standards ("NAAQS"). 42 U.S.C. 7409.

It is a "prohibited act" in violation of 42 U.S.C. 7522(a) for any manufacturer of a new motor vehicle or engine to sell, offer for sale, or introduce or deliver for introduction into commerce such vehicle and engine "unless [it] is covered by a certificate [or verification] of conformity issued (and in effect) under regulations" prescribed under Chapter 85 of Title 42 of the United States Code ("the Clean Air Act"). However, it is not a "prohibited act" to convert a motor vehicle or engine "for use of a clean alternative fuel," provided "such vehicle complies with the applicable standard under section 7521 [] when operating on such fuel." 42 U.S.C. 7522(a).

If EPA issues a certificate or verification of conformity when EPA has failed its nondiscretionary duty set forth at 42 U.S.C. 7525 to test or require to be tested "in such manner as [EPA] deems appropriate" a new motor vehicle or engine for conformity with emissions standards promulgated under 42 U.S.C. 7521(a) (Motor Vehicles) or 42 U.S.C. 7547 (Nonroad

Engines and Vehicles) (together "vehicle emissions standards"), then the certificate or verification is *void ab initio* and the manufacturer of the new vehicle is in breach of 42 U.S.C. 7522(a)(1).

EPA has a nondiscretionary duty to "apply any adjustment factors" that it "deem[s] appropriate to assure that each vehicle or engine will comply during its useful life (as determined under section 7521(d)[]) with the regulations prescribed under section 7521." 42 U.S.C. 7525(a)(1). However, if a clean alternative fuel conversion renders the vehicle noncompliant "with the applicable standard under section 7521 [] when operating on such [alternative] fuel," 42 U.S.C. 7522(a), then the conversion amounts to unlawful tampering in breach of 42 U.S.C. 7522(a)(3).

For a fuel that EPA has chosen to register pursuant to 42 U.S.C. 7545(a), EPA has a nondiscretionary duty "on a regular basis" to require the fuel manufacturer to test for "the potential public health and environmental effects of the fuel." 42 U.S.C. 7545(b)(2). This nondiscretionary duty includes assurance of compliance with vehicle emissions standards, especially for a criteria pollutant such as NO2, due to its serious, negative public health and environmental effects EPA determined when it found it necessary to adopt a NAAQS for NO2.

42 U.S.C. 13220(f)(1) defines "biodiesel" as "a diesel fuel substitute produced from nonpetroleum renewable resources that meets the registration requirements for fuels and fuel additives [] under section 7545." **Yet in breach of its nondiscretionary duty under 42 U.S.C. 7545(a) and (b), EPA fails to require biodiesel manufacturers to test for, and comply with, nitrous oxide vehicle emissions standards. It violates other nondiscretionary duties stated herein by permitting emissions noncompliant engines and alternative fuel conversions.**

The Clean Air Act grants EPA plenary legal authority to regulate fuel content, characteristics and measurements, as they relate to combustion emissions, and to require the collection and storage of data. 42 U.S.C. 7414, 7521, 7542(a), 7545, and 7601(a) (identified in the Final Rule published at 85 Fed. Reg. 78412, at 78465 (Dec. 4, 2020), as authority underlying part 80, Registration of Fuels and Fuel Additives, of Title 40 of the Code of Federal Regulations). EPA has exercised this authority in the past. For instance, EPA requires fuel manufacturers to measure the aromatic content of petroleum diesel fuel at the point of manufacture, for sole use in determining the legality of the fuel's emissions for sale of the fuel on the market. 40 C.F.R. 1090.1350(b)(2).

Most states, including Virginia, adopt fuel quality mandates by reference to standards developed by the private, non-profit organization ASTM International's Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants ("ASTM's Petroleum Products Committee").

See, e.g., Virginia Code section 59.1-167.1 (referring to the Uniform Fuels and Automotive Lubricants Regulation published by the National Institute of Standards and Technology in Handbook 130, which incorporates by reference ASTM fuel standards). However, ASTM's Petroleum Products Committee does not consider emissions to be an element of a fuel's performance, and is in the process of, or has already completed, removing all emissions-centric characteristics and test measurements, such as for aromatics, from its foundational standard for petroleum diesel fuel adopted by reference in most states' law, ASTM D-975 Standard Specification for Diesel Fuel.

As explained below, there is no reason pertaining to, or excuse from, EPA's nondiscretionary duties why the Agency cannot, did not, and does not also mandate measurement of the biodiesel, or its feedstock's, Iodine Value as a predictor of emissions-compliant NO2. The same goes for generic "biofuel" which EPA permits unlawfully to be run in engines bearing the alternative fuel conversion system developed by Optimus Technologies, Inc. and LLC.

Nitrous Oxide Emissions Vary According to the Biodiesel and "Biofuel" Feedstock

In 2022, the last year for which data for both fuels is publicly available, the production volume of biodiesel in the United States was 1.62 billion gallons, or 2.6 percent of the approximately 62 billion gallons of No. 2 petroleum diesel fuel sold that year. www.statista.com/statistics/509875/production-volume-of-biodiesel-in-the-us; www.eia.gov/dnav/pet/pet_sum_mkt_dcu_nus_m.htm (both checked 11/2/25 at 10:51 p.m. E.T.). The U.S. Energy Information Administration seems no longer to publish fuel prices after 2011; assuming an average sales price of $3.50 per gallon that year, total sales of biodiesel were approximately $5.7 billion.

POP Diesel's predecessor company became aware of the foregoing breaches of statutory duty in 2014 when EPA published on its website a verification of the conformity of Optimus Technologies, LLC with vehicle emissions standards for its alternative fuel conversion system to run on "diesel / biofuel."

POP Diesel was the first, in 2013, to secure a verification from EPA for select, outside-useful life engines running on No. 2 petroleum diesel fuel and 100 % *jatropha* plant oil fuel. Initially, EPA gave POP Diesel approval to run these engines on nondescript plant oil, but then Steve DeBord of EPA's Transportation and Air Quality Compliance Division, Diesel Engine Compliance Center, limited this approval to solely the kind of plant oil the Company had tested with, fruit seed oil of the *jatropha curcas* tree.

In preparation for applying for EPA's approval for its after-market clean alternative fuel conversion system and fuel, POP Diesel tested a variety of different plant oils to determine their emissions characteristics when running at 100 percent concentration in the Company's test vehicle and engine. Soy plant oil consistently produced higher nitrous oxide ("NO2") emissions than petroleum diesel fuel, and pure *jatropha* plant oil produced the same or lower NO2 emissions than petroleum diesel fuel. POP Diesel reported these results to EPA as part of its Comments on EPA's Proposed 2014 Standards for the Renewable Fuel Standard Program and submitted them electronically along with 52 exhibits on January 28, 2014 to Docket ID No. EPA-HQ-OAR-2013-0479, FRL 990-90-OAR, RIN 2060-AR76 at a-and-r-docket@epa.gov ("POP Diesel's Comments").

EPA itself determined that the source plant or animal oil has a significant effect on emissions outcomes from biodiesel. EPA, A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Draft Technical Report, EPA420-P-02-001, October 2002, pages 51-52 (Exhibit 14 to POP Diesel's Analysis). EPA's statistical analysis of 39 biodiesel emissions studies found that NO2 emissions were, on average and without attribution to any source feedstock, 10 percent higher for B-100 biodiesel than petroleum diesel fuel. David Korotney, EPA Analysis of the Exhaust Emissions Impacts of Biodiesel: Presentation to the Mobile Source Technical Advisory Subcommittee, October 16, 2002 ("EPA Statistical Analysis"), slide 7 (Exhibit 42 to POP Diesel's Comments). These biodiesel emissions results were different depending on whether the fuel derived from soybean oil, rapeseed (Canola) oil, or animal fats. EPA Statistical Analysis, slides 8 and 13.

According to the National Renewable Energy Laboratory of the U.S. Department of Energy ("NREL"), there is a great variability in NO2 emissions, depending on the source content of biodiesel feedstock. Bob McCormick, Effect of Biodiesel on Pollutant Emissions (for the Biodiesel Utilization Workshop in Boise, Idaho on September 9, 2004), NREL ("NREL Report"), slides 11 and 16 (Exhibit 12 to POP Diesel's Comments). The number of double carbon bonds in a biodiesel molecule "can have a large effect on biodiesel properties." NREL Report, slide 9. The number of double carbon bonds is measured by reacting them with iodine, giving an Iodine Value. Id. A higher Iodine Value indicates more highly unsaturated biodiesel and therefore, higher NO2 emissions and lower cetane number. Id., slides 9-12. NREL reports NO2 neutrality, meaning no higher or lower NO2 emissions than petroleum diesel fuel, at an Iodine Value of 95. Id., slide 13. Soy plant oil's Iodine Value is typically greater than 120. Id. *Jatropha*'s tested at 82.2. Intertek Report No. US 621-11262 (Exhibit 50 to POP Diesel's Comments). Palm oil is a more highly saturated plant oil that will therefore, have a lower Iodine Value. NREL Report, slide 10.

If the biodiesel was processed from waste cooking oil, the nitrous oxide emissions could have been anywhere on the scale, since waste cooking oil can come from all manner of animal and plant oil feedstock and an infinite variety of mixtures of them. If the biodiesel was from animal fat, it may produce no higher NO2 emissions than petroleum diesel does. NREL Report, slide 9. If the biodiesel was uniformly from a particular plant oil, the NO2 emissions, and whether they exceed the tipping point Iodine Value of 95, will depend on the source plant of the oil.

As transesterification of triglyceride (plant oil) molecules into biodiesel does not change the number of double carbon bonds, the Iodine Value in the source feedstock of biodiesel will be the same as with the final fuel. Therefore, the foregoing comments about variability of NO2 emissions will apply to a pure plant oil or other triglyceride feedstock, just as they do to biodiesel processed from such feedstock.

EPA's Seminal Failure to Screen for Excessive Nitrous Oxide Emissions from Biodiesel

From the results of Tier 1 testing for biodiesel that the National Biodiesel Board submitted to EPA pursuant to 42 U.S.C. 7545(b) in January 1998, prepared by Christopher A. Sharp of the Automotive Products and Emissions Research Division of the Southwest Research Institute ("SWRI") and approved by its Director Chris T. Hare ("NBB Biodiesel Tier 1 Testing"), it is apparent that EPA failed to ascertain and monitor for the source of feedstock used, to be able to measure the varying results for NO2 according to feedstock. This data provided EPA for biodiesel does not identify the source feedstock. However, pursuant to mandatory Tier 1 testing of NO2 emissions under 40 C.F.R. 79.52(b)(2)(i), the single source of neat biodiesel produced Transient NO2 Emissions that were 10 percent higher than when the same test engine was running on No. 2 petroleum diesel fuel, on average 5.17 versus 4.57 g/hp-hr. NBB Biodiesel Tier 1 Testing, page 9, Table 3.

Tier 2 data on biodiesel prepared by Lovelace Respiratory Research Institute dated May 22, 2000 that the National Biodiesel Board submitted to EPA pursuant to 42 U.S.C. 7545(b) identified the biodiesel feedstock tested as soy, but tested and measured NO2 emissions according to health standards (parts per million), rather than emissions standards (grams per horsepower-hour) promulgated under 42 U.S.C. 7521.

Therefore, the sole data that EPA had before it measuring biodiesel's compliance with the mandate stated at 42 U.S.C. 13220(f)(1) to satisfy the registration requirements of 42 U.S.C. 7545 showed NO2 emissions of nondescript neat biodiesel to be 10 percent higher than petroleum diesel fuel's.

POP Diesel submits that the requirement for testing stated in 42 U.S.C. 7545(b), as applied by 42 U.S.C. 13220(f)(1) to biodiesel, is rendered meaningless if the sole data before EPA was of a biodiesel fuel that produced worse NO2 emissions than petroleum diesel fuel, and EPA ignored this fact in order to give approval to the National Biodiesel Board's Tier 1 testing. In other words, EPA failed in its nondiscretionary duty by allowing biodiesel for sale which it knew from the very beginning would produce worse NO2 emissions than baseline petroleum diesel fuel. Since emissions standards have gotten progressively tighter over the years, EPA would have known that "worse than petroleum diesel" would mean biodiesel's causing engines and motor vehicles to fail emissions standards.

EPA's Continuing, Willful Violation of Its Nondiscretionary Statutory Duty to Limit NO2 Emissions from 100 Percent Biodiesel or "Biofuel"

Ten years after in 1998 EPA gave the National Biodiesel Board a pass on its Tier 1-reported excessive NO2 emissions, and several years after EPA's and NREL's own studies reported above that the source feedstock of biodiesel was determinative of NO2 emissions, in June 2008, Nextfuels submitted to EPA fresh Tier 1 data for its biodiesel, again with testing done by SWRI ("Nextfuels Biodiesel Tier 1 Testing"). It utilized biodiesel made from palm oil, which because of its high saturation, produced NO2 emissions no worse than petroleum diesel fuel's. Nextfuels Biodiesel Tier 1 Testing, at vii and 19. By that time, EPA knew that palm oil was not representative of the vast bulk of biodiesel on the American market coming from unsaturated plant oil and fat sources that would produce higher NO2 emissions than petroleum diesel fuel and thereby, violate emissions standards. U.S. Energy Information Administration, *Feedstocks Consumed for Production of Biofuels*, through August 2025.

EPA failed to act on this confirmation of its own Statistical Analysis showing that while biodiesel typically produced 10 percent higher NO2 emissions than petroleum diesel fuel, emissions results varied by feedstock source. EPA Statistical Analysis, slides 7, 8 and 13 (Exhibit 42 to POP Diesel's Comments). As a result, with a green light from EPA's willful disregard of its oversight responsibility, Nextfuels undoubtedly then manufactured biodiesel from the most widely available feedstocks in the United States, soy oil and waste yellow grease, which produce significantly higher NO2 emissions than petroleum diesel fuel and render an engine noncompliant with emissions standards, just as other biodiesel manufacturers reliant on the National Biodiesel Board's original Tier 1 and 2 testing noncompliant with NO2 emissions standards were doing.

Due to the statutory definition of "biodiesel" stated at 42 U.S.C. 13220(f)(1) as a fuel that is required to "meet[] the registration requirements for fuels and fuel additives [] under section 7545," EPA's seminal and ongoing violation of its mandatory duty under 42 U.S.C. 7545(a) and

(b) on a regular basis, to test or require testing of biodiesel fuel, as well as under 42 U.S.C. 7525(a)(1), was to fail to consider the NO2 emissions characteristics that can be predicted from the biodiesel's source feedstock, by its Iodine Value. These failures had profound consequences. They put the entire biodiesel industry in violation of the Clean Air Act, including **(i)** all new engines certified pursuant to 42 U.S.C. 7525 to run on any mixture of petroleum and biodiesel fuels, **(ii)** all new engines and engines in actual use verified by EPA to run in a clean alternative fuel conversion system pursuant to 42 U.S.C. 7521(a) on 100 percent biodiesel or any mixture of biodiesel and petroleum diesel fuel, **(iii)** all compression ignition engine manufacturers who made engines qualified to run on biodiesel, **(iv)** and biodiesel fuel suppliers. Hence, POP Diesel intends to join the Engine Manufacturers Association as a representative party-in-interest to any lawsuit hereon to speak for the engine manufacturing industry, without suffering any liability itself therefore. POP Diesel will consent to EMA's dismissal, if it so chooses.

Alternative Fuel Conversions for Neat Biodiesel and "Biofuel" Are Tampering

EPA approved Optimus Technologies LLC in 2014 to install an alternative fuel conversion system onto select, 2004 model year, outside-useful-life, 7.6 liter engines manufactured by International. Spreadsheet showing Outside-Useful Life Light-Duty and Heavy-Duty Clean Alternative Fuel Conversions, line 50, published at www.epa.gov/ve-certification/lists-epa-compliant-alternative-fuel-conversion-systems. The fuels EPA gave its approval to run in such Optimus modified engines were "diesel" and "biofuel." Id. EPA has never chosen to register "biofuel" as fuel pursuant to 42 U.S.C. 7545(a). Nonetheless, from my communications with EPA in 2014, it was clear that EPA never collected data tying the source feedstock to the NO2 emissions of the various kinds of "biofuel" it approved for use in Optimus Technologies-equipped alternative fuel conversion systems, which it could easily do by requiring measurement of the Iodine Value, or if it did collect NO2 emissions data according to the source feedstock of the "biofuel," it ignored the results in breach of its nondiscretionary duties, in order to permit use of generic "biofuel" in breach of NO2 emissions standards for motor vehicles.

As explained above, by allowing generic "biofuel," including 100 percent biodiesel, to power diesel engines without testing for and monitoring the "biofuel's" or its source feedstock's Iodine Value, EPA permitted diesel engines equipped to run on such fuel to produce NO2 emissions which were, are, and will be noncompliant with NO2 emissions standards adopted pursuant to 43 U.S.C. 7521 applicable to those particular engines.

While 42 U.S.C. 7522(a) gives EPA discretion to exempt clean alternative fuel conversions from the acts prohibited thereby, it still requires such vehicle "to comply with the applicable standard under section 7521 [] when operating on such fuel." 42 U.S.C. 7522(a). EPA violated its nondiscretionary duty to verify this mandatory criterion by failing to require an

accounting of the feedstock source of the "biofuel" and testing of its or the "biofuel's" corresponding Iodine Value, to verify this Value is at or below 95, as a proxy for its producing NO2 emissions that are no worse than the same engine running on petroleum diesel fuel. NREL Report (re. Iodine Value of 95 as tipping point for NO2 emissions comparison to petroleum diesel fuel).

Thus, the approval EPA gave Optimus Technologies, LLC in 2014 to install its alternative fuel conversion system on select 2004 models of 7.6 liter International engines for use with generic "biofuel" was contrary to law. Neither Optimus Technologies, nor EPA, had a lawful basis, as the former is required to prove and the latter to determine, that an engine itself so equipped and running on "biofuel" will be in "compl[iance] with the applicable standard [for NO2] under section 7521 [] when operating on such fuel." 42 U.S.C. 7522(a). "[S]uch [converted engine or] vehicle" itself is required to "comply with the applicable standard under section 7521." 42 U.S.C. 7522(a). EPA's Final Rule on Clean Alternative Fuel Vehicle and Engine Conversions forbids operating an outside-useful-life engine on alternative fuel that will produce emissions of any criteria pollutant, such as NO2, that are higher than when the same engine is running on the original fuel it was certified new to run on, in the case of Optimus, No. 2 petroleum diesel fuel. EPA-OAR-2009-0299, FRL-9289-9 published at 76 Fed. Reg. 19830.

Optimus Technologies, Inc., is thus in violation of the anti-tampering provisions of 42 U.S.C. section 7522(a) for installing or selling its kit to run on "biofuel," including 100 percent biodiesel, contrary to law. It likely did this from its Pittsburgh headquarters or at the sites of its customers, first ADM, who pioneered a 1.3-million-mile study and since then, "leading commercial fleets and municipalities who have travelled a total of more than 125 million miles" with the Optimus kit installed. https://www.optimustec.com/about-us/ (checked 11/3/25).

Optimus Technologies, Inc. seems to have gained a testing exemption under 42 U.S.C. section 7522(b)(1) to install its alternative fuel conversion system on new, Class 8 Volvo VNR Sleeper and Freightliner Cascadia Sleeper Trucks.
https://share.hsforms.com/19.2zJL1n1IT0S00uGDa1PPXAnuumy and
www.prnewswire.com/newsr-releases/proven-decarbonization-technology-available-on-new-class-8-trucks-302159788.html ("Optimus News Release" dated May 30, 2024 and checked 11/2/25).

As of May 30, 2024, Fontaine Modification Company was installing the Optimus kit on "hundreds of new orders" at its 11 engine modification centers around the country. These locations can be found at https://fontainemodification.com/ship-thru-locations/, and include 5135 Cougar Trail Road, Dublin, Virginia 24084 and 6450 Technology Drive, Salem, Virginia 24153.

Id.; https://fontainemodification.com/fontaine-modification-acquires -probilt-services-of-denton-texas/ (checked 11/4/25).

Since Optimus Technologies, Inc.'s testing exemption violates the requirement of 42 U.S.C. 7522(a) that the 100 percent biodiesel or "biofuel" advertised to run in the foregoing engines produce emissions compliant with the standards adopted under authority of 42 U.S.C. 7521, Fontaine Modification Company is violating this same anti-tampering provision by installing the Optimus kit, just as when it makes an Optimus installation on the International engine the latter won EPA consent for in 2014.

GFL Environmental, Inc., the fourth largest diversified environmental services company in North America, has the Optimus kit installed on some of its solid waste collection trucks having the 2004 model year, 7.6 liter International engines in them, which I have seen and taken photographs of in Charlottesville, Virginia. A list of GFL Environmental, Inc.'s Virginia trucking locations is at https://gflenv.com/lcations/virgnia/, including its closest facilities to Charlottesville: 5498 Richmond Road, Troy, Virginia 22974 and 261 Industrial Drive, Ruckersville, Virginia 22968. GFL Environmental, Inc. may also have this kit on new Volvo and Freightliner models it owns that are part of the Optimus testing exemption program, installed by Fontaine Modification Company. Presumably, GFL Environmental, Inc. has the Optimus kit on other of its 7,100+ trucks based at any of its 315 landfills, transfer stations, organics facilities, and waste separation and recycling centers in the United States and Canada.

GFL Environmental, Inc., and its biodiesel or "biofuel" suppliers, are subject to notification by EPA and a court injunction to prevent them from supplying its trucks already equipped with the Optimus kit with emissions non-compliant 100 percent biodiesel or "biofuel" producing excessive NO2 emissions in breach of heavy duty emissions standards due to the particular kind of feedstock used.

Similarly, since Optimus Technologies, Inc. "has established trusted partnerships with OEMs, modification centers, and national refueling providers," it can provide information as to others contributing to breaches of the same standards, limitations or orders it is violating.

Particular NO2 emissions standards these three named trucking companies violated or are at risk of violating as part of the Optimus testing exemption are stated in the "Final Rule for Phase 2 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles," adopted October 25, 2016 and applicable to model years 2018 to 2027 of various categories of vehicles and engines; and EPA Final Rule "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," adopted December 20, 2022 and applicable to model years 2027 and beyond.

Since the activities set forth above are obviously part of the business enterprises and plans of the foregoing three companies, this notice is properly directed to their addressees identified in the letterhead, as the chief executives of these three companies responsible for the alleged violations. 40 C.F.R. 54.3(b).

EPA's Concealment in Defiance of Its Nondiscretionary Statutory Duty to Limit NO2 Emissions from 100 Percent Biodiesel or "Biofuel"

When POP Diesel brought the foregoing topic to EPA's attention informally in August 2014, specifically the need to utilize Iodine Value of the biodiesel or "biofuel" or its feedstock source, Agency officials pointed the finger at each other and then banned further communications with him on this subject. First, on August 4, 2014, Dr. Fakhri J. Hamady, Technical Advisor on Engines in the Ann Arbor, Michigan Compliance Division of EPA's Office of Transportation & Air Quality ("OTAQ"), directed POP Diesel to Jim Caldwell of EPA's Fuel Compliance Center. Then on August 7, 2014, Jim Caldwell responded, "[T]his is an issue for the engine folks in Ann Arbor. I deal with fuel composition and rely on the experts in Ann Arbor with respect to an engine's emissions performance."

I sought a teleconference with these and related EPA staff to try to see if everyone was on the same page. Then on August 13, 2014, Justin G. Greuel, Director of EPA's Diesel Engine Compliance Center, wrote me, noting that he was copying the Director of the Fuels Compliance Center, Mr. John Weihrauch, and the Director of the Light-Duty Vehicle Center, Mr. Linc Wehrly:

> [Your] topic[] do[es] not fall within our Centers' area of expertise or authority. Given the significant workload in front of our teams with implementing current regulatory programs, we respectfully decline your meeting request. Similarly, we are directing our staff not to respond to other questions on this matter.

Conclusion

While the information stated above in EPA and NREL documents may have come to the Agency after the National Biodiesel Board on behalf of biodiesel fuel manufacturers submitted their Tier 1 emissions performance admitting worse NO2 emissions than petroleum diesel fuel, even counting the excessive NO2 emissions stated therein as a one-off aberration, they put EPA on inquiry notice. EPA's nondiscretionary duty pursuant to 42 U.S.C. 7545(b) on a regular basis to test or require manufacturers of biodiesel to test for NO2 emissions is inescapable. The reference in the definition of "biodiesel" stated in 42 U.S.C. 13220(f)(1) to "meet[ing] the

registration requirements for fuels and fuel additives [] under section 7545[(b)]" must be given some meaning. If EPA contends that a one-time submission of Tier 1 data pursuant to 40 C.F.R. 79.52(b)(2)(i) at the beginning of a fuel's use and introduction to the market, a submission that showed noncompliance, no less, followed ten years later by testing solely on palm oil biodiesel known to produce extraordinary favorable NO2 emissions results, suffices to satisfy EPA's nondiscretionary statutory duty "on a regular basis" to test or require testing under 42 U.S.C. 7545(b), then EPA by its own knowledge and come 2014, its concealment of its knowledge, demonstrated awareness of its breach thereof, making its failures all the more galling to public health and the environment.

Pursuant to 40 C.F.R. 54.3, the person providing this notice is POP Diesel Africa, Inc. at the addresses and telephone number appearing in the letterhead of this letter. Please send all correspondence and communications regarding this matter to me at the above addresses. There may be other interested plaintiffs joining in any lawsuit POP Diesel is forced to file, if this letter fails to elicit a satisfactory resolution within the 60 days required by law.

POP Diesel would prefer to resolve this matter without resorting to litigation. If you would like to discuss a path to resolution, please contact me, or have your lawyer do so. If I do not hear from you within 60 days, the Company will be forced to assume that you are not interested in settling this matter, and will be prepared to file a complaint in United States District Court.

If any recipient of this letter would like copies of any document cited in this letter, or if you have any questions, please do not hesitate to contact me by email. Thank you for your understanding and consideration.

Sincerely yours,

/s/

Claude David Convisser

cc: State authorities

Exhibit 2

United States Environmental Protection Agency
Air and Radiation
EPA420-P-02-001
October 2002

A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions

Draft Technical Report

Printed on Recycled Paper

Table IV.B.1-1
P-values for test cycle effects

	NOx	PM	HC	CO
% biodiesel	**0.0002**	**0.0001**	**0.0001**	**0.0001**
R49 × % biodiesel	0.4144	**0.0256**	0.3733	**0.0016**
UDDS × % biodiesel	0.1782	0.7031	0.5709	0.2358
UDDSH × % biodiesel	NA	NA	NA	NA

Table IV.B.1-2
Estimated coefficients for test cycle effects

	NOx	PM	HC	CO
% biodiesel	0.000855	-0.006292	-0.011469	-0.006863
R49 × % biodiesel	0.000600	0.005147	0.006599	0.005646
UDDS × % biodiesel	0.000131	-0.000151	-0.000654	0.000335
UDDSH × % biodiesel	0.000000	0.000000	0.000000	0.000000

For the test cycle adjustment terms, p-values greater than 0.05 suggest that the effect in question cannot be confidently distinguished from zero. In these cases the statistically significant overall '% biodiesel' term would apply to the individual test cycle term as well, indicating that there is no variation in the biodiesel effect on emissions as a function of test cycle. The two exceptions to this conclusion are for PM and CO where R49 data appears to exhibit different biodiesel effects than data collected on the FTP. This result is consistent with previous experience: steady-state test cycles are generally not accurate predictors of the PM and CO emissions that would be generated under transient conditions. Based on this result, we decided to exclude R49 data from our final PM and CO correlations.

2. Biodiesel source effects

All biodiesel blends in our database were placed into one of three biodiesel source categories: soybean, rapeseed/canola, and animal. We introduced terms into the regression analysis which represented the interaction of these biodiesel source categorical variables with percent biodiesel to determine which ones might be statistically significant. As described in Section III.C.2.c, coefficients could be estimated for only two of the three potential interactive terms because an overall % biodiesel term was also included. The p-values for the % biodiesel terms are listed in Table IV.B.2-1, and the estimated coefficients are given in Table IV.B.2-2. P-values lower than 0.05 were considered significant.

Table IV.B.2-1
P-values for biodiesel source effects

	NOx	PM	HC	CO
% biodiesel	**0.0001**	**0.0001**	**0.0001**	**0.0003**
Animal × % biodiesel	**0.0001**	**0.0001**	0.5525	**0.0001**
Rape × % biodiesel	**0.0311**	0.6316	0.9162	**0.0164**
Soy × % biodiesel	NA	NA	NA	NA

Table IV.B.2-2
Estimated coefficients for biodiesel source effects

	NOx	PM	HC	CO
% biodiesel	0.001553	-0.000908	-0.001031	-0.000603
Animal × % biodiesel	-0.001216	0.024410	0.000022	-0.000838
Rape × % biodiesel	-0.000331	0.007517	0.000038	-0.000316
Soy × % biodiesel	0.000000	0.000000	0.000000	0.000000

For NOx and CO, the three biodiesel source categories appear to produce three different correlations between biodiesel concentration and emissions. For PM, animal-based biodiesel appears to differ from plant-based biodiesel. For HC, there is no discernable difference between the three source categories. The biodiesel source effects for NOx, PM, and CO are shown in Figures IV.B.2-1, IV.B.2-2, and IV.B.2-3, respectively.

Exhibit 3

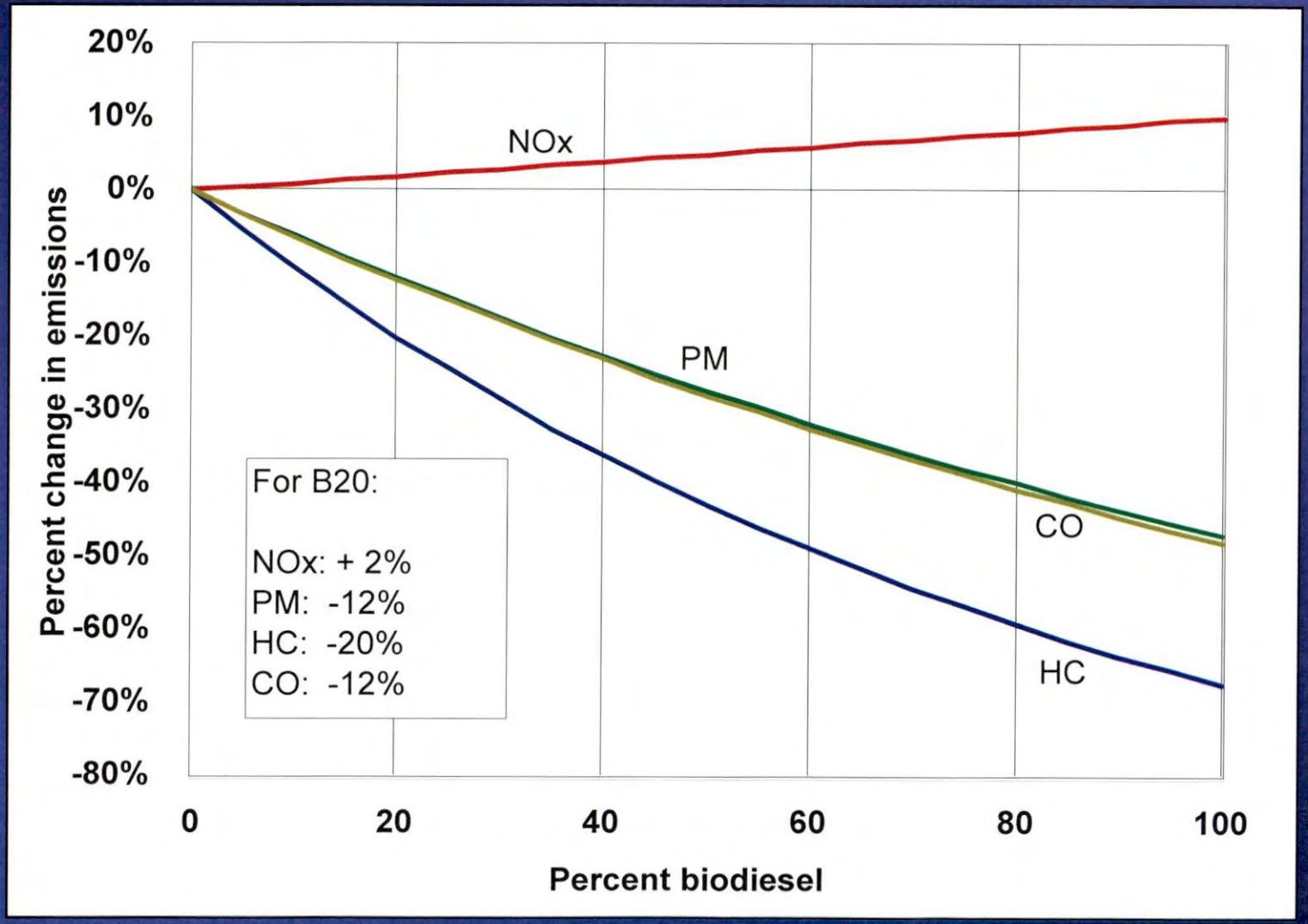
EPA Analysis of the Exhaust Emission Impacts of Biodiesel

Presentation to the Mobile Source Technical Advisory Subcommittee

David Korotney

October 16, 2002

Basic emissions effects

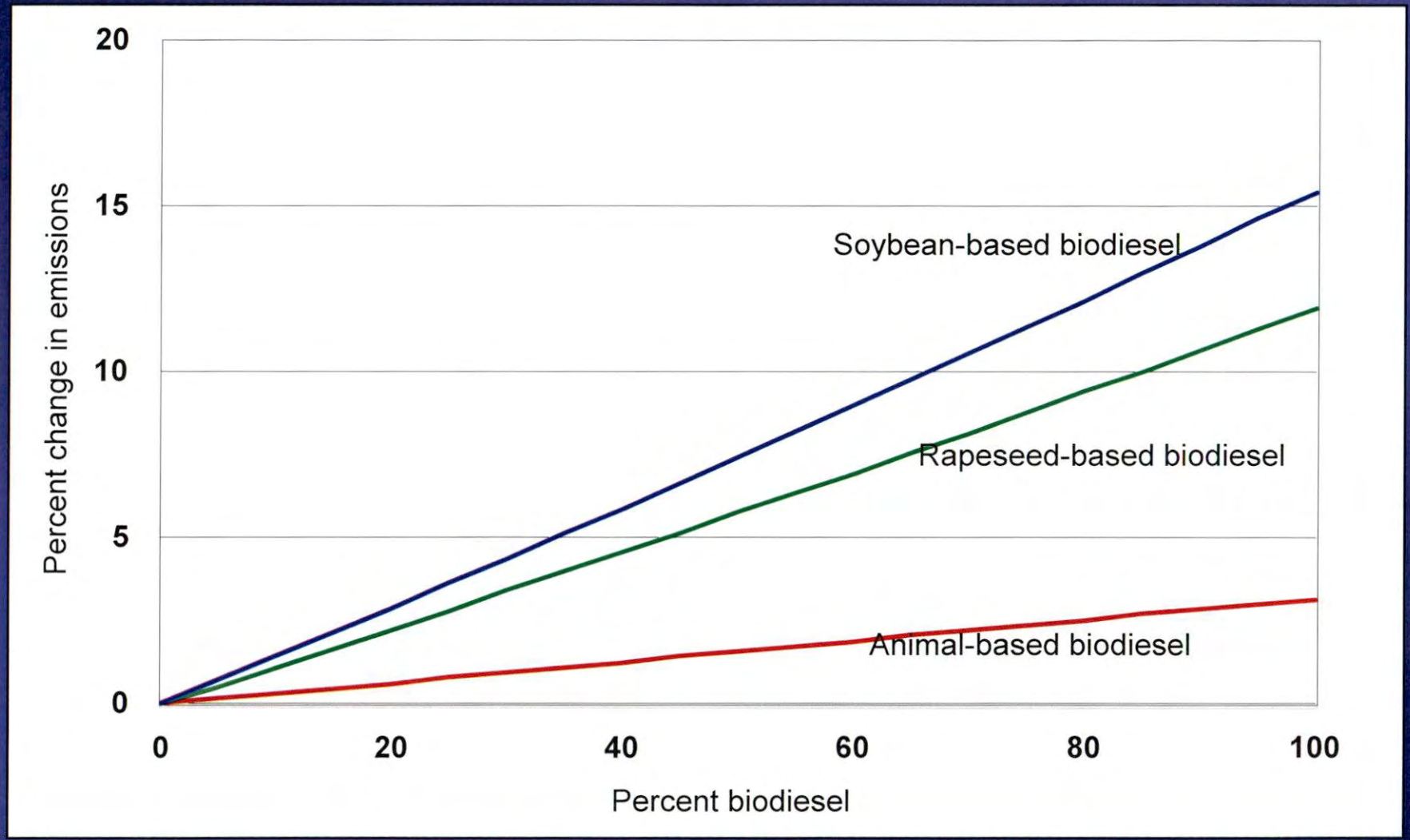


Deliberative draft for stakeholder review

Investigations

- We also investigated whether the emission effects might be:
  - Nonlinear — No
  - A function of engine technology — Mostly no
  - A function of test cycle — Yes
  - Different for soybean, rapeseed, and animal fats — Yes
  - A function of the "cleanliness" of the base fuel — Yes

Type of Biodiesel - NOx



Deliberative draft for stakeholder review

Exhibit 4

A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

National Renewable Energy Laboratory

Innovation for Our Energy Future

Effects of Biodiesel on Pollutant Emissions

Bob McCormick
National Renewable Energy Laboratory
Golden, Colorado

Biodiesel Utilization Workshop
Boise, Idaho
September 9, 2004

Acknowledgement

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

Office of FreedomCAR and Vehicle Technologies
Fuels Technology Subprogram

NREL National Renewable Energy Laboratory

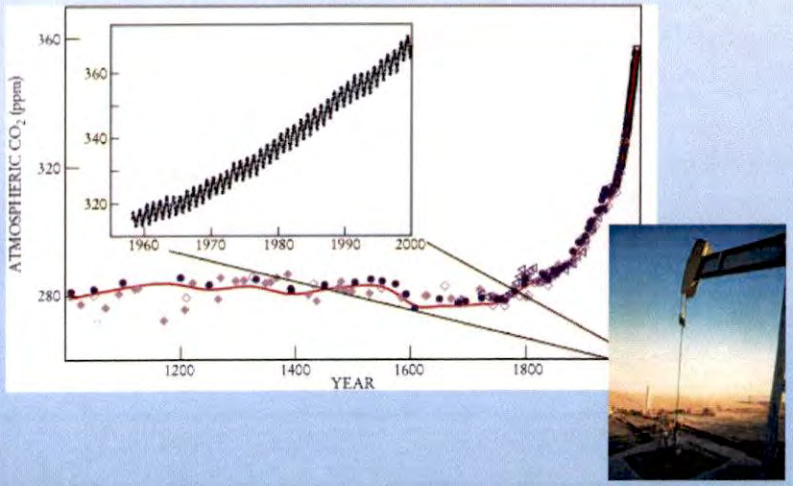
Why Use Biodiesel?

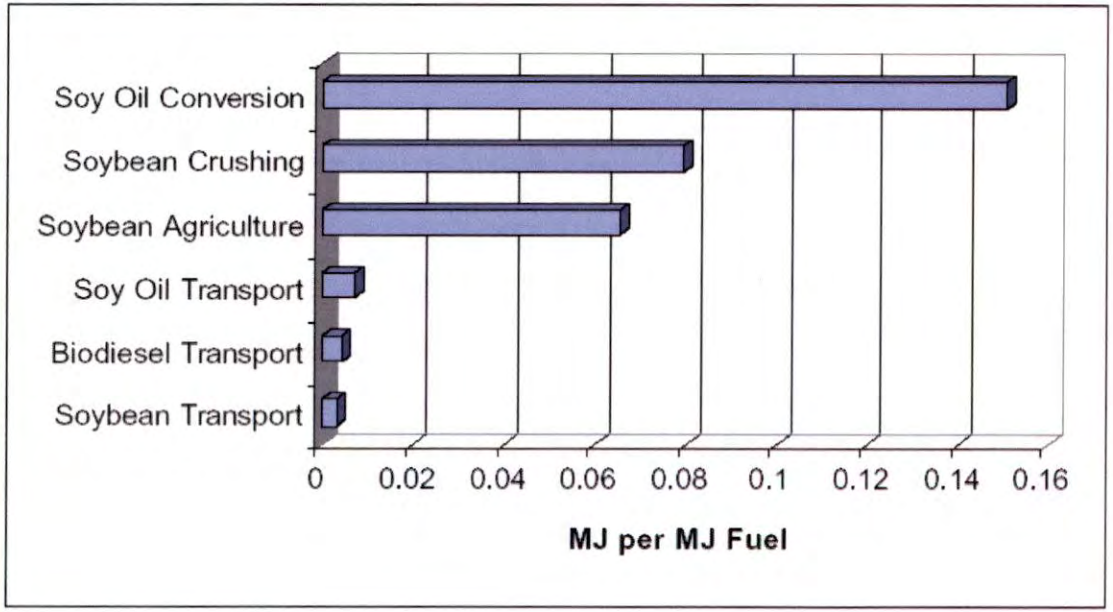
Energy Security and Global Warming Benefits

$$\text{Fossil Energy Ratio (FER)} = \frac{\text{Energy Delivered to Customer}}{\text{Fossil Energy Used}}$$

For soybean-based biodiesel = 3.2

- *Amount of fossil energy used in biodiesel production is similar to that used in petroleum production*
- *A small fraction of fuel energy-truly renewable*



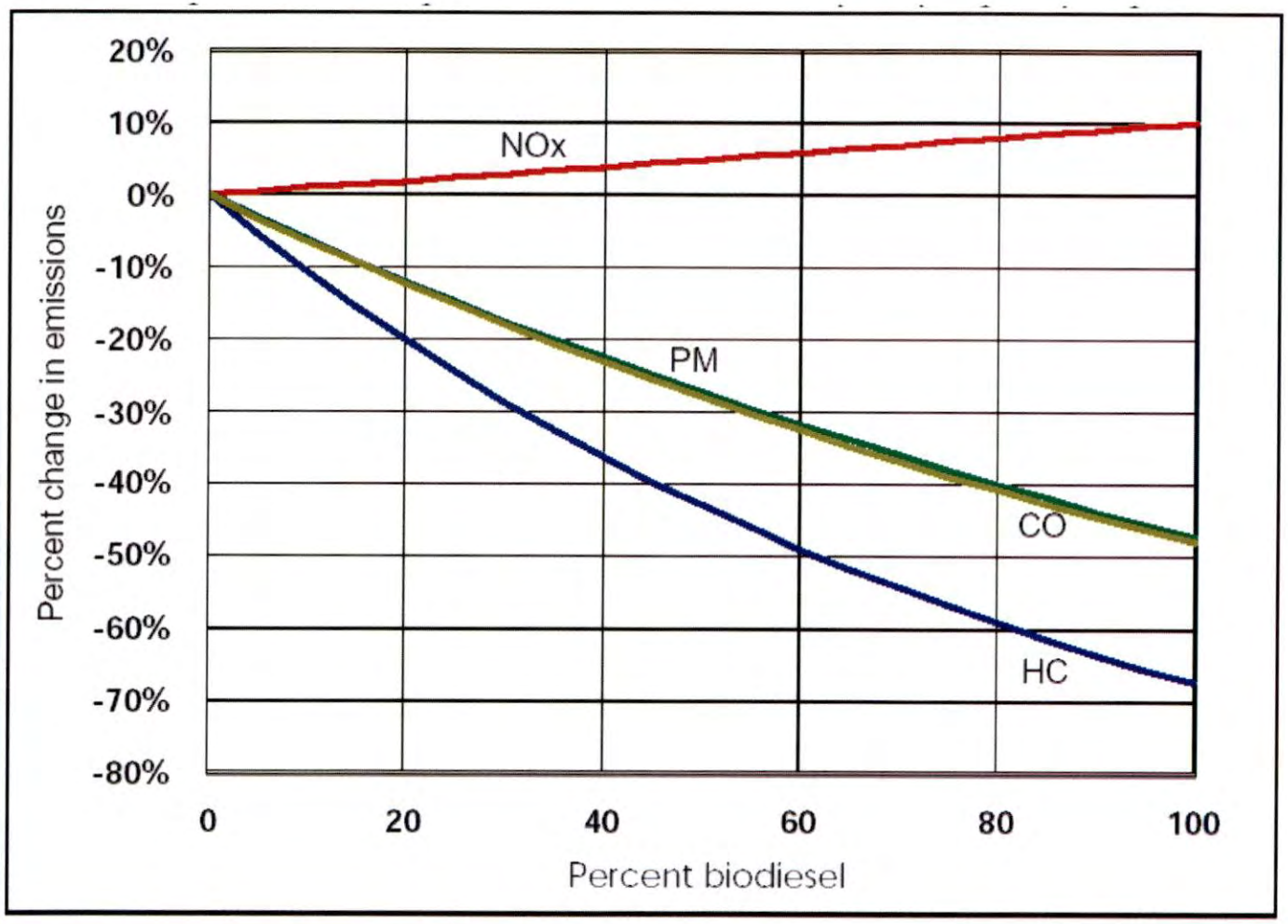


Analysis from NREL/TP-580-24772, May 1998

Overall Effect on Emission – Older Engines

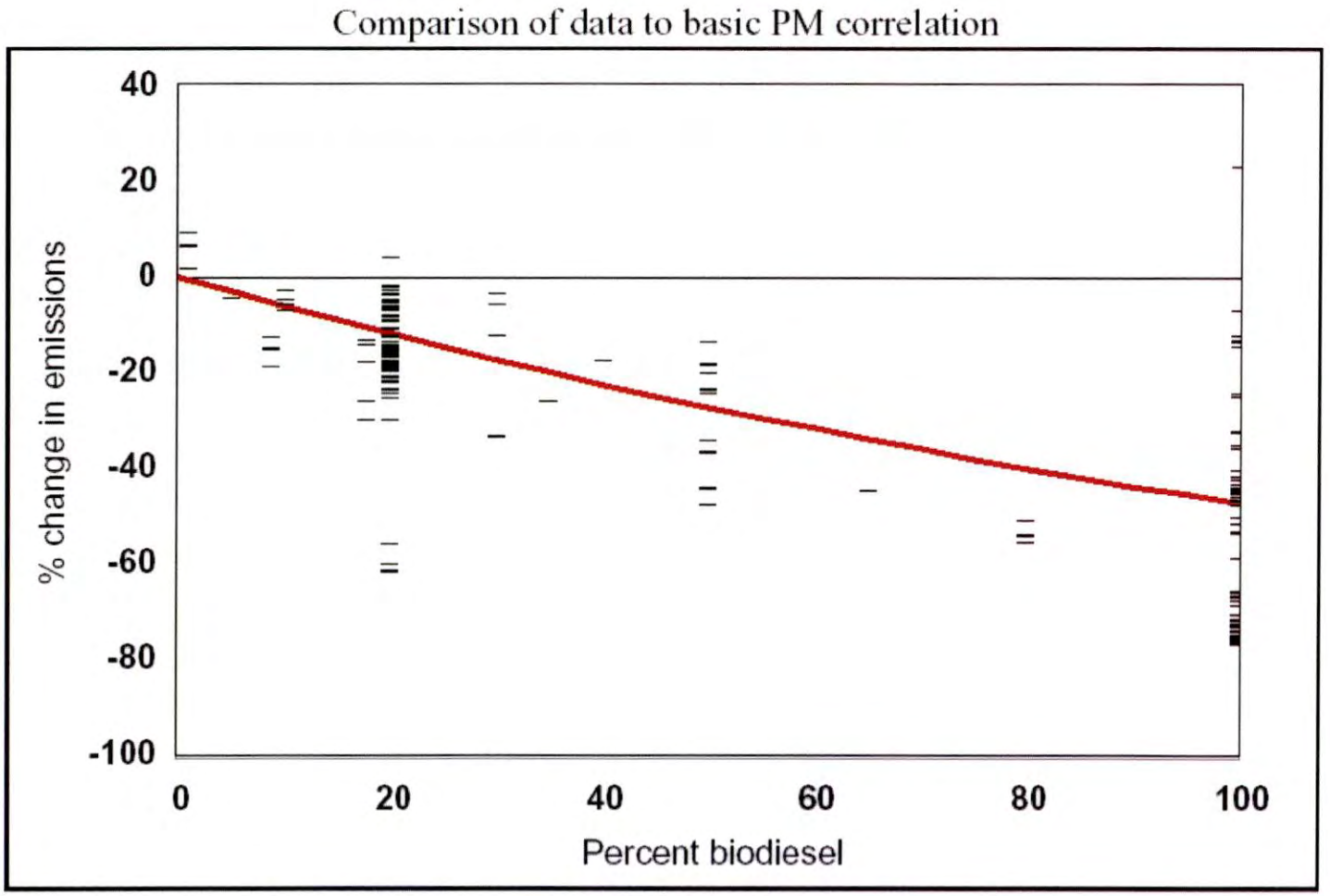
EPA analysis:
- data from many studies
- engine models through 1997

- NOx
  - 2% up for B20
  - 10% up for B100
- PM
  - 10% down for B20
  - 48% down for B100



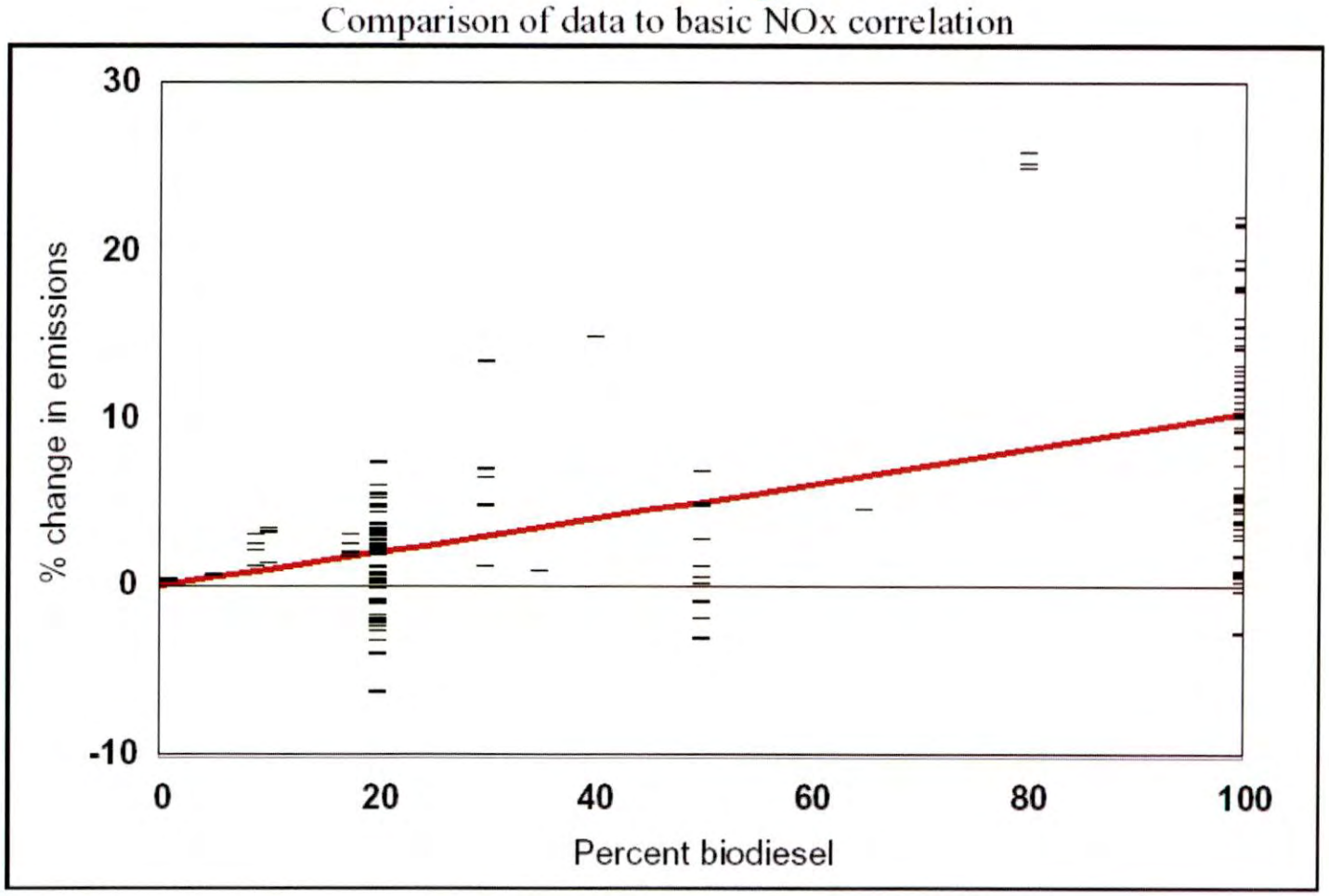
Analysis from EPA420-P-02-001, October 2002

Variation in PM Emissions Data – EPA Analysis



PM emission reduction occurs in almost every test

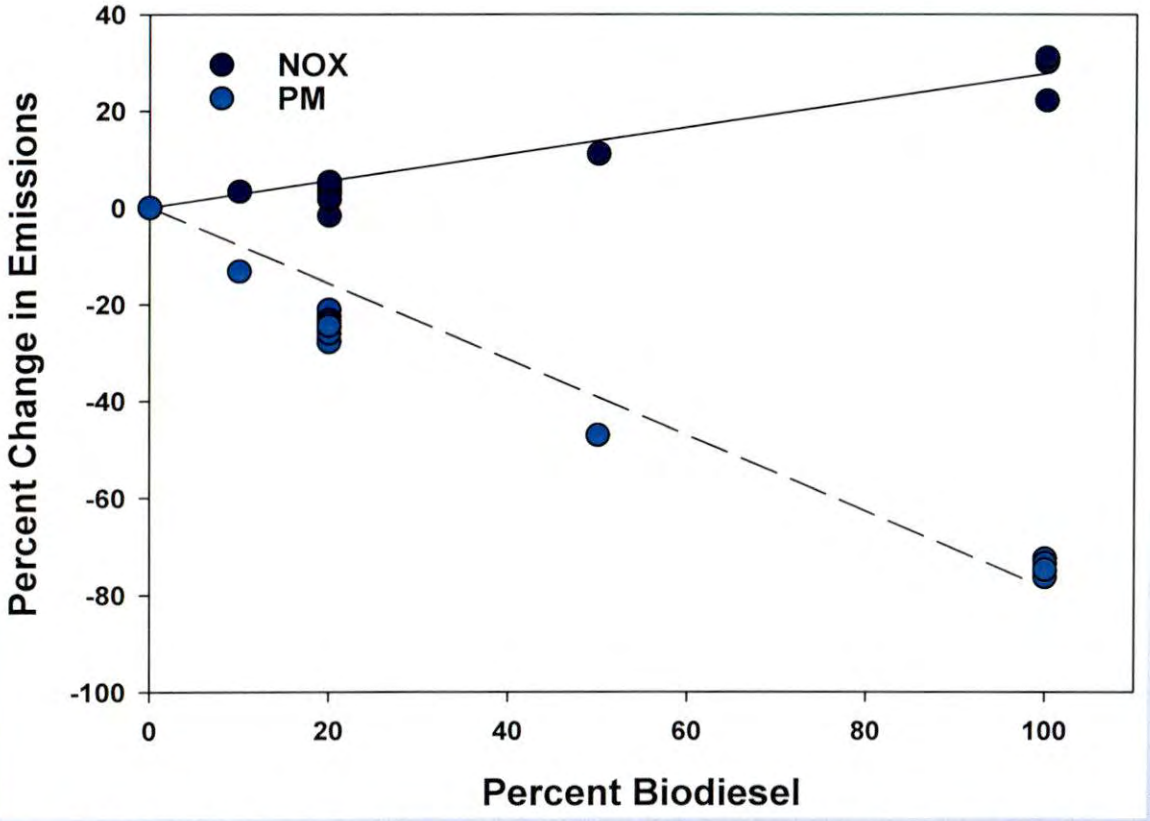
Variation in NO_x Emissions Data – EPA Analysis



NO_x increases consistently for B100

For B20 many tests also show a NO_x decrease

2004 Engines – New Data



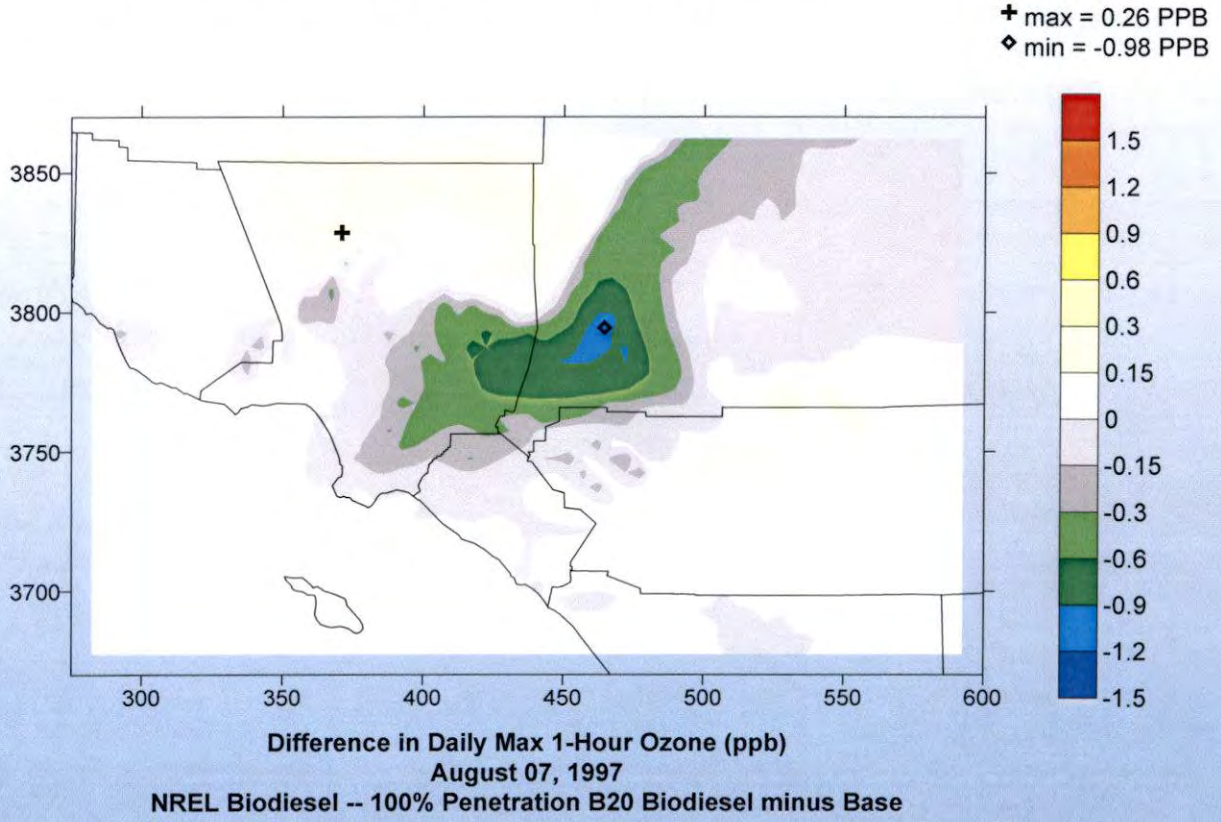
- Cummins ISB and DDC S60
- Heavy-Duty FTP
- Compared to ULSD

- NOx increase compared to older engines
  - 3.1% vs 2.0% for B20
  - 28% vs 10% for B100
- PM reduction compared to older engines
  - 26% vs 10% for B20
  - 74% vs 48% for B100

Results fall within the range observed for older engines

Air Quality Modeling for Biodiesel

- Impact of 100% market penetration of B20 on air quality in Chicago area, Northeast Corridor, and South Coast Air Basin.
- NO_x from B20 use has no negative air quality impact (changes in ozone less than 1 ppb).
- PM emission reduction has no positive impact.



Difference in Daily Max 1-Hour Ozone (ppb)
August 07, 1997
NREL Biodiesel -- 100% Penetration B20 Biodiesel minus Base

Analysis from NREL/SR-540-33793, April 2003

Biodiesel Chemistry

- **Methyl (or ethyl) esters of fatty acids**

oleic acid

linoleic acid

linolenic acid

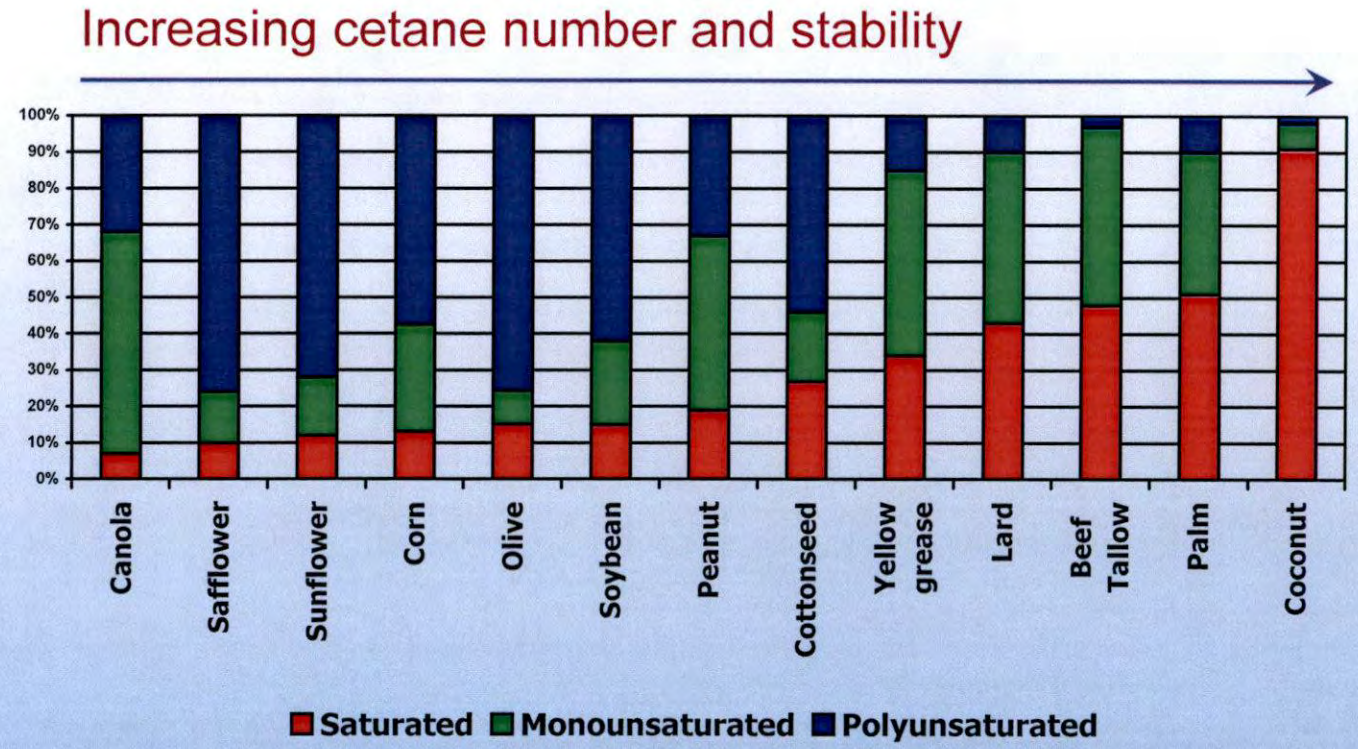
Monounsaturated

Polyunsaturated

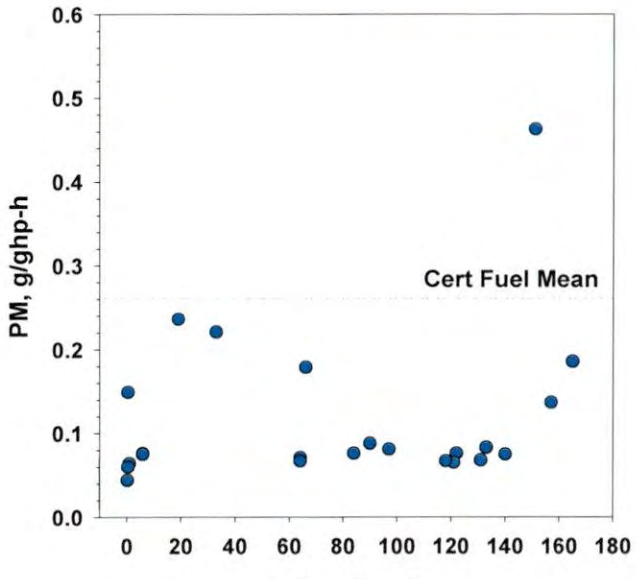
- **Number of double bonds can have a large effect on biodiesel properties**
- **Can be measured by reacting double bonds with Iodine, so-called Iodine Value**
- **Higher Iodine Value indicates more highly unsaturated biodiesel**

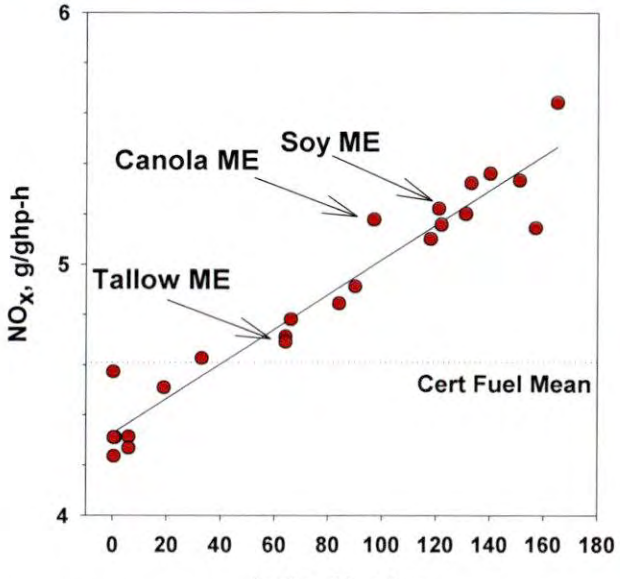
Biodiesel Composition

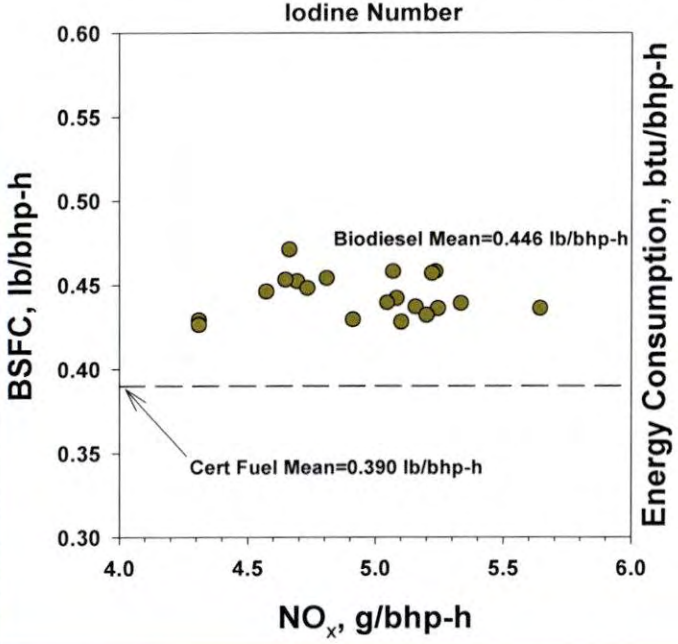
- Composition mirrors the fatty acid content of the feedstock
  - Animal fats, palm, coconut oils are more highly saturated
    - Higher CN
  - Fuels high in polyunsaturates can be less stable

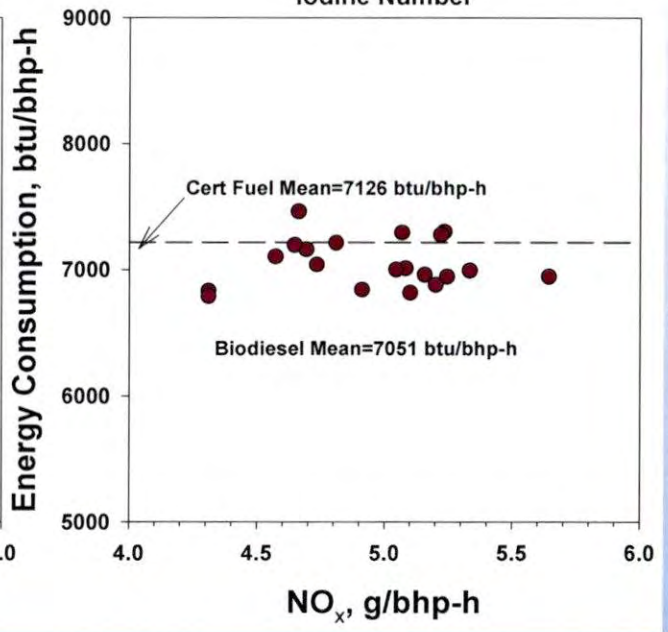


Effect of Biodiesel Composition







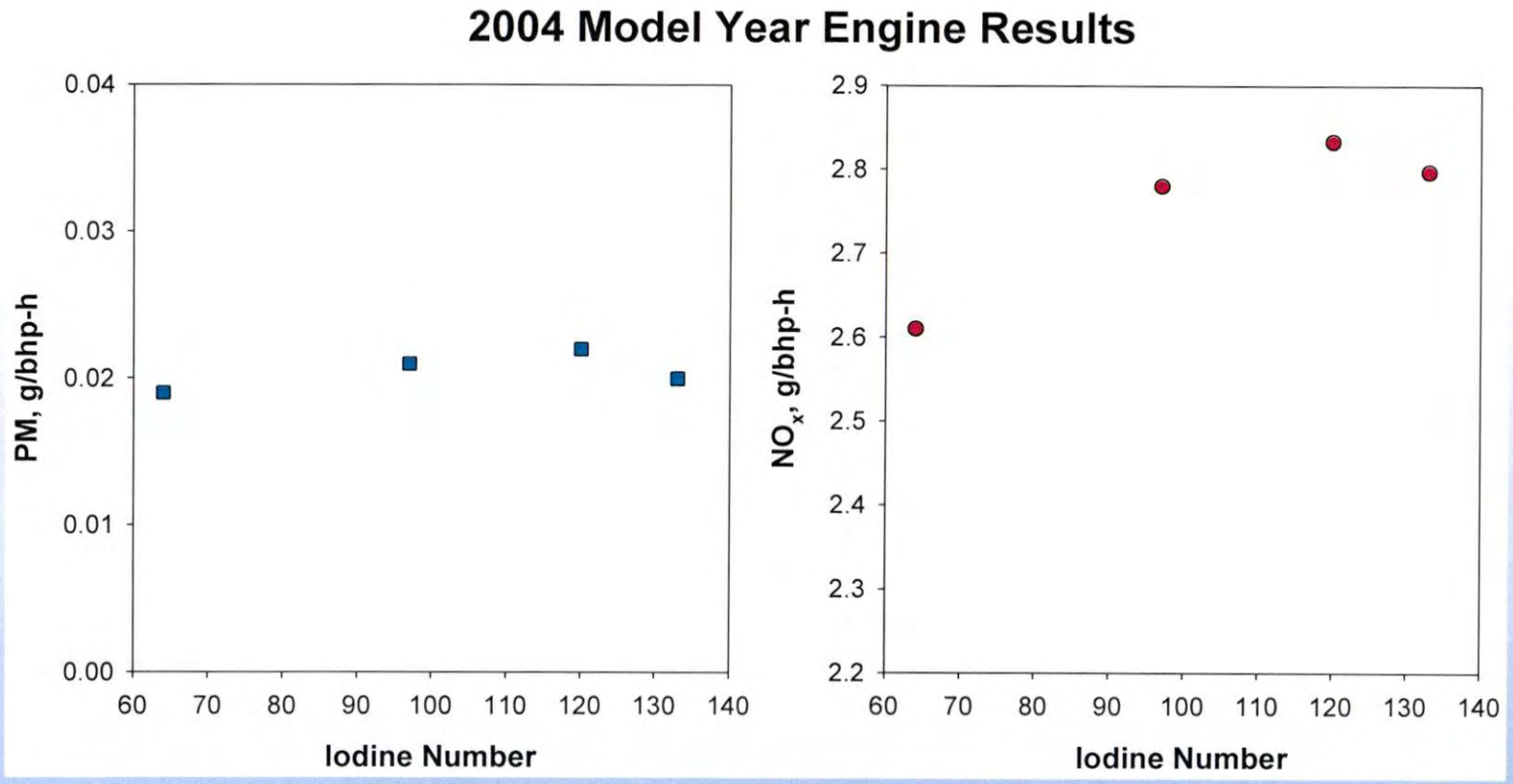


- NO_x emissions correlated with fuel unsaturation
- NO_x varies by 1 g/bhp-h but energy consumption varies by less than 2%

- Data from *Environ. Sci. & Technol. 35 1742-1747 (2001),*
- DDC Series 60 engine (1991)
- HD FTP
- B100 compared to LSD

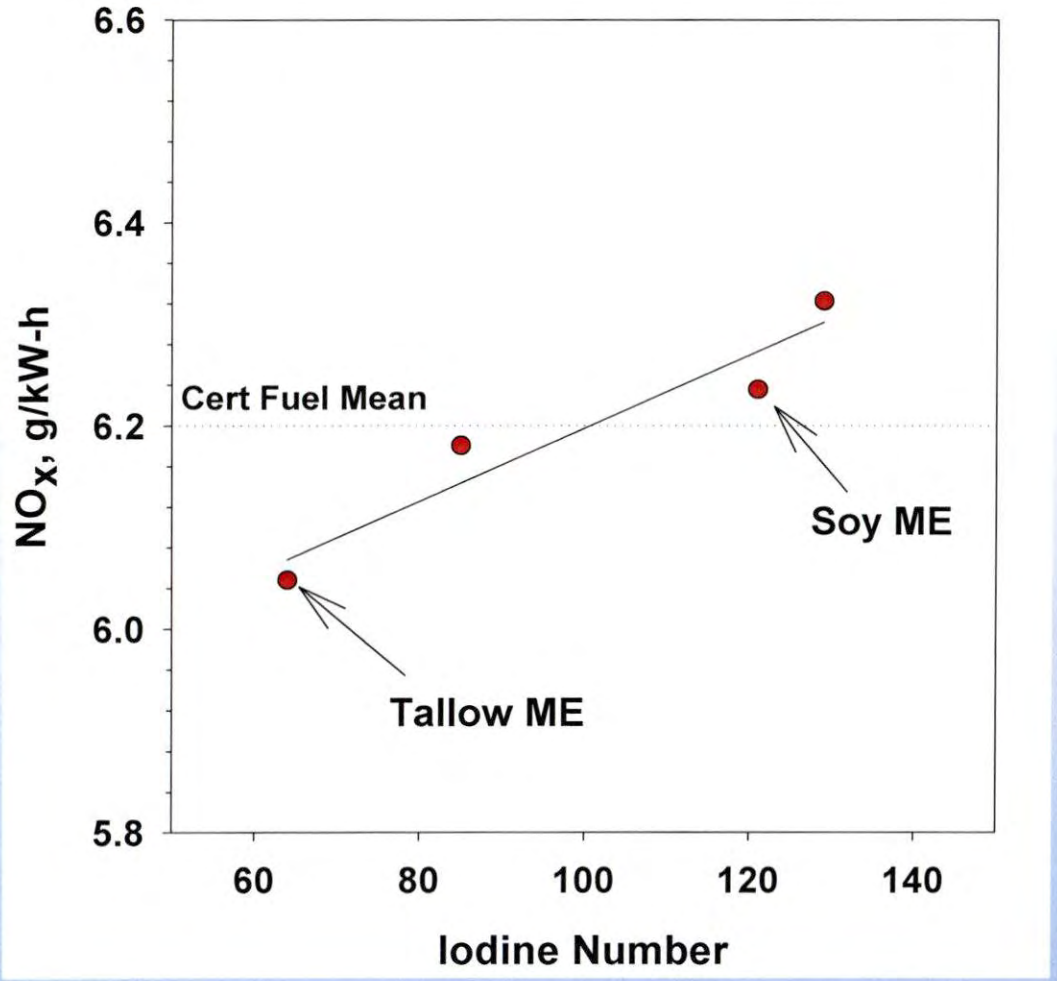
Biodiesel Composition – 2004 Engine

2004 engine shows similar but smaller effect



Effect of Biodiesel Composition for Blends

NO_x emissions for B20 blends versus biodiesel Iodine Number:



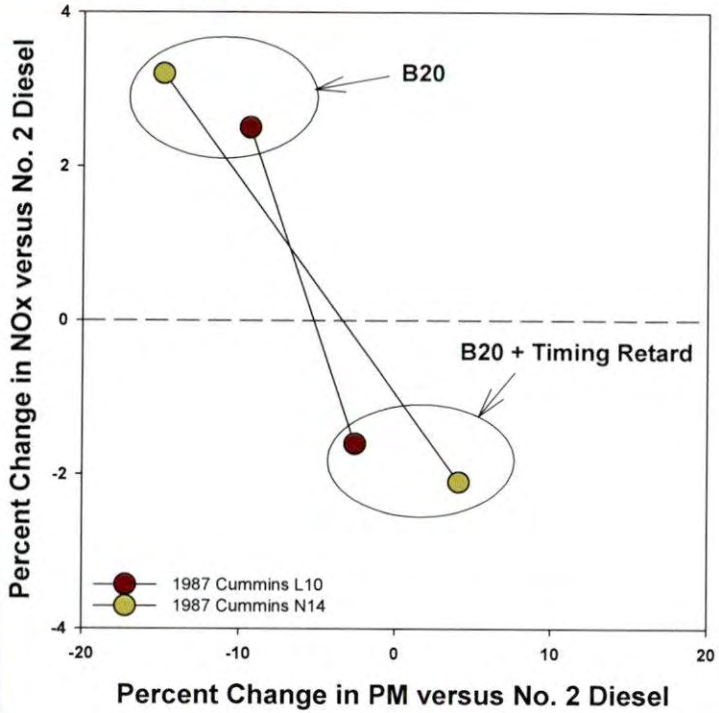
- NO_x neutrality at Iodine Number of roughly 95
- I.N. is typically >120 for soy
- Suggests blending of high and low I.N. fuels may be a strategy to eliminate the NO_x increase

NO_x Reduction Strategies

Injection timing retard:

- Can eliminate NO_x increase for pre-1998 engines
- Reduces or eliminates PM benefit
- Can reduce fuel economy
- Requires engine calibrated for biodiesel

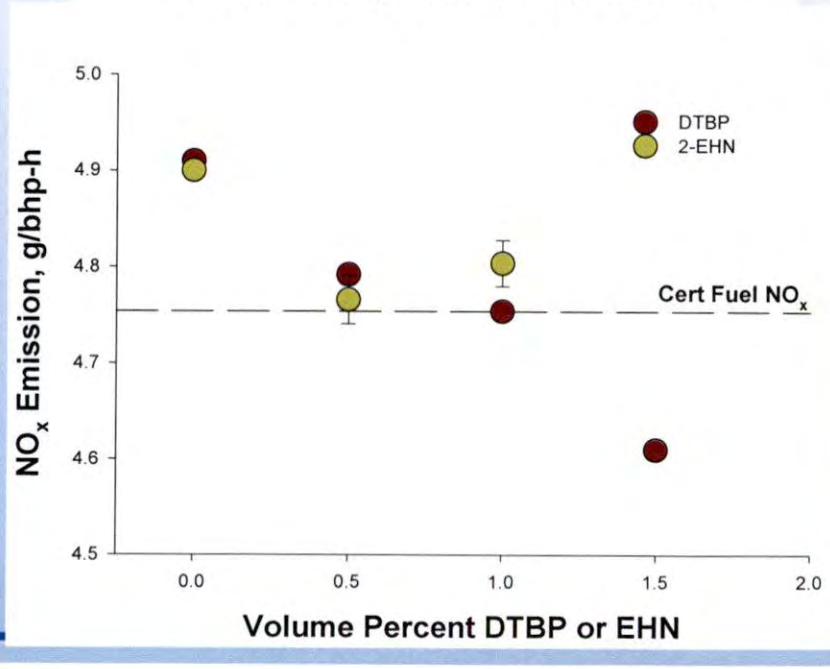
Graboski & McCormick, Progress in Energy and Combustion Science, 24 125 (1998).



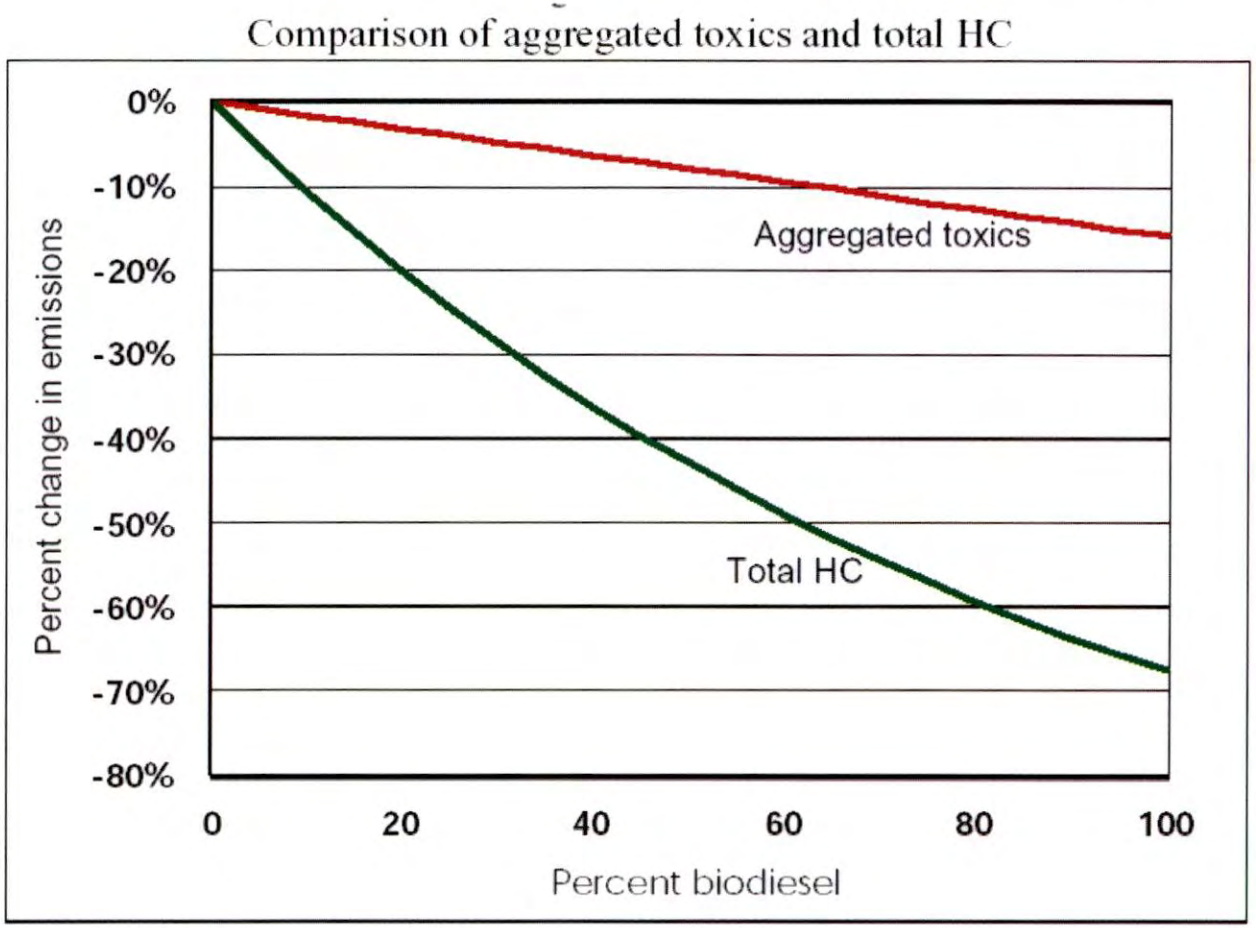
Cetane increasing additives:

- Effective for soy B20
- NO_x reductions significant at 95% confidence or greater
- No change in PM emissions or fuel economy

McCormick, et al., SAE Tech. Pap. No. 2002-01-1658



Gaseous Toxics Emissions



Significantly lower for biodiesel

Closing Remarks

- Biodiesel is truly renewable: reduces petroleum consumption and CO_2 emissions
- B20 may increase NO_x emissions
  - Air quality modeling suggests this is insignificant
  - Reducing NOx is likely to require either:
    - Making biodiesel more saturated
    - Changing engine controls (injection timing and other)
- B20 reduces emissions of PM and toxic compounds
- Modern (2004) engines show a PM reduction and NO_x increase within the range observed for older engines

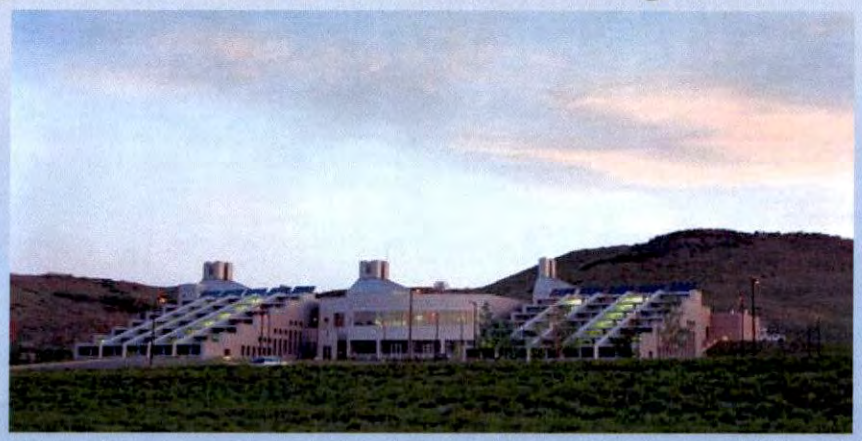


Exhibit 5

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Report No. US621-11262

Report of Analysis

Client:	Plant Oil Powdered Diesel Fuel Sytems, Inc.
Description:	Plant Oil
Laboratory reference number:	56681.92771
Date Submitted:	October 7, 2013
Marks/Reference:	Pop Diesel

Method	Test	Result	Units
AOCS Ce1-62	*Fatty Acid Composition-*		wt. %
	C6	0.00	
	C8	0.00	
	C10	0.47	
	C12	0.15	
	C14	0.08	
	C14-1	0.00	
	C15	0.00	
	C16	14.12	
	C16-1	0.69	
	C17	0.09	
	C17-1	0.04	
	C18	6.48	
	C18-1	43.20	
	C18-2	32.94	
	C20	0.22	
	C18-3	0.65	
	C20-1	0.12	
	C22	0.07	
	C22-1	0.00	
	C24	0.11	
	C24-1	0.05	
AOCS Cd 1d-92	Iodine Value	82.2	
AOCS Cd 12b-92	Oxidative Stability	0.2	hrs
AOCS Ca 17-01	Sulfur	1.3	ppm
AOCS Ca 20-99	Phosphorus	20.8	ppm
AOCS Cc7-25	Refractive Index @ 20°C	1.4684	

The reported results are only representative of the sample submitted for testing to Intertek Agri Services New Orleans Laboratory. Any sample references and identification is reported as submitted and is not verified by Intertek Agri Services New Orleans Laboratory as a representative sample.

For and on behalf of
Intertek Agricultural Services

Signed and dated in: St. Rose, LA
on: October 23, 2013

Sandra Holloway, Laboratory Director

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Exhibit 6

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San Antonio, Texas 78228-0510

CHARACTERIZATION OF BIODIESEL EXHAUST EMISSIONS FOR EPA 211(b)

By

Christopher A. Sharp

FINAL REPORT
CUMMINS N14 ENGINE

Prepared for

National Biodiesel Board
1907 Williams Street
Jefferson City, MO 65110-4898

January 1998

Reviewed:

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Emissions Research Division

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I. INTRODUCTION

This report contains results from a test program conducted at Southwest Research Institute (SwRI) on behalf of the National Biodiesel Board (NBB). The objective of the program was to characterize regulated and unregulated exhaust emissions from a 1997 Cummins N14 engine while fueled on biodiesel and diesel fuel. It is understood that the data generated in this program will be submitted to EPA in order to comply with Tier I requirements under section 211(b) of the Clean Air Act.

II. DESCRIPTION OF PROGRAM

This section of the report describes the test engine, test fuels, and test procedures used during this program.

A. Test Engine

The test engine used to generate the data in this report was a 1997 model year Cummins N14 diesel truck engine. This engine was a direct-injected, four stroke, six cylinder diesel engine of in-line configuration. The engine was turbocharged and intercooled, and employed an electronically-controlled fuel injection system having unit injectors. Engine throttle control input was achieved via an electronic potentiometer which was connected to the test cell servo controller. The engine had a nominal rated maximum power on 2-D diesel fuel of 370 hp at 1800 rpm, and a nominal peak torque of 1450 lb-ft at 1200 rpm. No aftertreatment was employed by the engine. Transient test cell installation of the Cummins N14 engine for this program is shown in Figure 1.

FIGURE 1. TRANSIENT TEST CELL INSTALLATION OF THE CUMMINS N14 ENGINE

The new engine was received from Cummins and placed in a durability test cell for break-in. The engine was fueled initially on neat biodiesel, and checked for power and torque. Observed torque levels were roughly seven percent below nominal levels. This was expected due to the biodiesel fuel's lower energy content compared to conventional diesel fuel, and the lower torque was consistent through all testing on neat biodiesel. Following this initial running, 125 hours of operation were run over a durability cycle supplied by Cummins, again using only neat biodiesel fuel. The details of this cycle are given in Appendix A. The engine was then relocated to a transient test cell for emissions testing.

B. Test Fuels

Two test fuels were used during this program, which included a neat (100%) biodiesel fuel, and a neat (100%) diesel fuel. Selected properties for the biodiesel and the diesel fuel are given in Tables 1and 2, respectively.

The biodiesel fuel was supplied by Ag Environmental Products. This fuel is referred to in this report as "B100," and was coded SwRI EM-2481-F. The fuel was delivered via tanker to SwRI and stored in an underground tank which was cleaned and rinsed with fuel from the same batch as the test fuel prior to the introduction of biodiesel. New test cell fuel systems were also constructed to prevent contamination of the fuel stream to the engine with diesel fuel.

The diesel fuel for this program came from a batch of diesel fuel that had been specially blended in order to meet the specifications required by the 211(b) regulations, as outlined in CFR 40 Part 79. This fuel is referred to in this report as "2D," and was coded SwRI EM-2494-F. The fuel was delivered to SwRI in 55 gallon drums.

C. Test Procedures

1. Transient Testing and Regulated Emissions Measurement

Exhaust emission characterization was performed as specified under CFR Title 40 Part 79. For heavy-duty engines, the regulation specifies that emissions are to be measured over the heavy-duty transient Federal Test Procedure (FTP), as outlined in CFR Title 40 Part 86 Subpart N. The FTP outlines specific requirements for setting up the test engine and mapping the engine's full torque capabilities over its operating speed range. Engine-specific performance data are used, along with a normalized EPA transient cycle, to define a transient command cycle for test engine operation.

While the engine is operated over the 20-minute test cycle, torque and speed responses of the engine are compared to the command cycle to ensure FTP compliance. Simultaneously, engine exhaust gases are diluted with conditioned air, and emissions of interest are determined. Work generated by the engine is also recorded during the cycle. The FTP specifies both a cold-start test cycle (following an overnight soak) and a hot-start test cycle, with a 20-minute soak between the two test cycles. Measured emission masses for both cycles are weighted to produce a composite mass of one-seventh cold-start mass and six-sevenths hot-start mass. This composite mass is divided by a similarly weighted composite work to generate a brake-specific emission value in terms of mass of pollutant per unit of work generated.

TABLE 1. SELECTED TEST FUEL PROPERTIES FOR B100

Fuel	B100
SwRI Fuel Code	EM-2481-F
Cetane Number, D-613	51.2
Flashpoint, D-93, F	367
Viscosity, D-445, cSt	4.08
Sulfur, D-2662, wt%	0.0000
Sulfated Ash, D-874	0.003
Carbon Residue, D-524 (100%)	0.05
Acid Number, D-664	0.14
Water and Sediment, D-1796	<0.02
Copper Strip Corrosion, D-130	1A
Total Glycerine, wt%	0.17
Free Glycerine, wt%	0.01

TABLE 2. SELECTED TEST FUEL PROPERTIES FOR 2D

Fuel	2D
SwRI Fuel Code	EM-2494-F
Cetane Number, D-613	43.3
Cetane Index	45.2
Distillation, D-4052, F	
IBP	378
10%	438
50%	511
90%	609
EBP	666
API Gravity, D-4052	33.8
Sulfur, D-2662, wt%	0.0476
Aromatics, FIA, wt%	39.1
Olefins, wt%	1.7
Saturates, wt%	59.2

For the sampling of semivolatile polycyclic aromatic hydrocarbons (PAH), this procedure was modified because it was not possible to accumulate sufficient volume on the sampling media during a single test to meet EPA specified detection requirements. However, it was necessary to preserve the one-seventh/six sevenths weighting between cold-start and hot-start testing in order to compare this data with all other emission data. Therefore, semivolatile PAH samples were accumulated in a single set of media over one cold-start cycle and six successive hot-start cycles, with a 20-minute soak between cycles. The total mass measured was then divided by the total work produced during all seven test cycles to provide a composite brake-specific emission value.

Regulated emissions measured during this program included total hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_x), and particulate matter (PM). Hydrocarbons were measured using continuous sampling techniques employing a heated flame ionization detector (HFID). CO and CO_2 were determined using proportional dilute gaseous samples analyzed with non-dispersive infrared (NDIR) instruments. NO_x was measured continuously during the transient cycle via an NO_x chemiluminescence instrument. Total PM levels were determined by collecting particulate matter on a set of 90mm Pallflex filters which were weighed both before and after the transient test. Regulated emissions were measured over the cold-start cycle and the first two hot-start cycles, but composite values were generated using only the cold-start and the first hot-start as specified by the FTP.

2. Particulate Characterization

Particulate samples from the cold-start and the first two hot-starts were analyzed to determine the general composition of the particulate emissions by several methods. Filter samples were analyzed for soluble organic fraction (SOF) via a Soxhlet extraction method using a 30-70 mixture of toluene and ethanol as the solvent. Sulfate levels were determined via an ion chromatograph. Both of these analyses were performed on sections of the 90mm Pallflex filters.

3. C_1 to C_{12} Hydrocarbon Speciation

Hydrocarbon emissions from C_1 to C_{12}, including aldehydes, ketones, and alcohols, were measured during this program. These analyses were performed on samples from the cold-start and the first hot-start only. Samples were also generated during the second hot-start, but these were only examined if a problem was observed with samples from the first hot-start, which did not occur during testing of the Cummins N14 engine.

Gaseous hydrocarbons from C_1 to C_{12}, except for aldehydes, ketones, and alcohols, were determined by analyzing proportional bag samples of dilute exhaust using a series of gas chromatographs, each optimized for a different carbon number range. The methods used for this analysis were the same as those developed for Phase II of the Auto Oil Program.[1]

---

[1]Siegl, W.O., Richert, J.F.O., Jensen, T.E., Schuetzle, D., Swarin, S.J., Loo, J.F., Prostak, A., Nagy, D., and Schlenker, A.M., "Improved Emissions Speciation Methodology for Phase II of the Auto/Oil Air Quality Improvement Research Program - Hydrocarbons and Oxygenates," SAE Paper 930142, Special Publication SP-1000.

Aldehydes and ketones from C_1 to C_8 were sampled and analyzed using a 2,4-dinitrophenylhydrazine (DNPH) technique outlined in CFR 40 Part 86 Subpart N for methanol engines. Samples were obtained via impingers containing the DNPH solution, and these samples were analyzed via a high performance liquid chromatography (HPLC) instrument. This procedure was modified to add additional aldehyde compounds above C_6 to the target compound list.

Although alcohol emission measurements were not required for biodiesel by EPA, NBB elected to perform some measurement of alcohols. Samples were obtained using an impinger sampling method similar to that used for aldehydes, but using water instead of DNPH as the sampling solution. Samples were analyzed using a gas chromatograph. The target list of alcohols included methanol, ethanol, t-butanol, 2-propanol, and 1-propanol.

4. Polycyclic and Nitrated Polycyclic Aromatic Hydrocarbons (PAH/nPAH)

PAH and nPAH emissions were sampled in both the particulate phase and semivolatile phase. Particulate samples were obtained using a second secondary dilution tunnel which was operated in parallel with the first tunnel used to obtain 90mm filter samples. This tunnel was considerably larger than the first one, to allow for the use of 20 x 20-inch Pallflex sampling media. This larger media size was necessary in order to obtain sufficient sample to meet EPA detection requirements for PAH and nPAH compounds. Filter samples were generated for the cold-start and the first two hot-start tests, although only samples from the cold-start and the first hot-start were analyzed.

Semivolatile PAH and nPAH samples presented a particular problem, in that conventional sampling techniques would not allow for sufficient sample to be gathered to meet EPA detection requirements. Commercially available sampling media and hardware were of insufficient size to allow for the volume flow rates needed. However, even with custom built sampling hardware, the maximum sampling media size was also limited by the ability to extract and concentrate samples obtained. Therefore, an approach was devised involving both custom built sampling hardware and a modified sampling plan. The modified plan, involving running multiple tests with a single set of sampling media, is described above.

The final sampling hardware setup for semivolatile PAH and nPAH emissions consisted of a pair of sample cartridges (rather than the usual single cartridge) which were mounted in parallel on the larger secondary dilution tunnel, after the 20 x 20 inch filter media used for particulate phase sampling. These cartridges were sized to allow a media diameter of 4 inches, rather than the conventional 2.5 inches. This larger diameter allowed for a much higher flow rate to be used, while maintaining the face velocity within levels comparable to recommended levels for the smaller, conventional sampling media. The sample cartridges were loaded with a layered sampling media consisting of a 1.25 inch deep layer of polyurethane foam (PUF), a 0.5 inch deep layer of XAD-2 resin, and a second 1.25 inch deep layer of PUF. The XAD-2 resin was incorporated to improve the trapping efficiency for nPAH compounds, which were expected to be present in much lower levels than PAH compounds. After sampling, the two cartridges were extracted (with PUF and XAD-2 materials extracted separately) and the extracts were combined to form a single sample.

The combination of two larger sample media sets and multiple test runs allowed for the accumulation of a sample volume similar to that passing through a 20 x 20 inch filter during a single test (roughly 3000 standard cubic feet). This volume of sample was sufficient to allow for the analysis to meet the required detection threshold of 0.5 ng/hp-hr. A sample set for a given test day consisted of a cold-start filter sample, a hot-start filter sample, and a pair of PUF/XAD-2 cartridges for the semivolatile phase. A background PAH/nPAH sample set was obtained by operating the sampling systems with sampling media loaded, but without the engine operating, for 2 hours in order to obtain sufficient volume.

Following testing, sample sets were delivered for analysis. In the case where immediate extraction was not possible, both PUF/XAD-2 and filter samples were stored at 4°C. All samples were Soxhlet extracted for 16 to 18 hours. For the pair of semivolatile samples, the PUF and XAD-2 portions of both sample cartridges were separated and extracted. The PUF portion of the sample was Soxhlet extracted with Hexane/Ether (94:6). The XAD-2 portion of the sample was extracted with 100% methylene chloride. Both portions were combined to form a single sample before cleanup. After extraction, the sample extracts were cleaned up by an acid wash and elution through a column packed with activated silica gel.

The samples were analyzed using several GC/MS instruments, as detailed below. For each analysis, a 1μL aliquot of the sample extract was injected into the instrument. For quantitation, an internal standard solution, made up of several deuterated PAH or nPAH compounds, was spiked into the extract at the time of analysis, and was used for calculating response factors.

Analysis of Nitro-PAH compounds was performed on a Finnigan 4500 HRGC/LRMS using chemical ionization in the negative ion mode. Sample extracts were analyzed for regular PAHs on a Fisons MD800 HRGC/LRMS in the selected ion monitoring (SIM) mode. All PUF/XAD-2 samples required still higher resolution mass spectrometer analysis due to interferences which affected the accurate quantitation of detected analytes. In this case, a VG Autospec Ultima HRGC/HRMS in the SIM mode was used for the analysis.

III. TEST RESULTS

This section of the report details the test results from the Cummins N14 engine. It is divided into several sections, concerning the results from each kind of exhaust emission characterization that was performed.

A. Regulated Emissions and Particulate Composition

Regulated emission levels for the Cummins N14 engine on the two test fuels are given in Table 3. Triplicate FTP tests were run on both the neat B100 fuel and the neat 2D fuel. Although regulated emissions were measured on both the cold-start and the first two hot-starts of the test sequence for each given day, composite emission levels were generated using only the cold-start and the first hot-start. Detailed results of individual transient tests are given in Appendix B. A new transient torque-map was run for each FTP test.

Comparing B100 to 2D fuel, measured HC emissions were essentially eliminated by B100. CO emissions were reduced by 50 percent with neat B100, as compared to 2D, primarily as a result of the oxygen in B100. NO_x emissions, however, were about 13 percent higher with neat B100 as compared to 2D.

Particulate emissions with B100 were 30 percent below the levels observed for 2D fuel. Particulate composition data for the N14 engine is given in Table 4. B100 reduced insolubles in the particulates by more than 80 percent, likely as a result of the oxygen in the fuel. However, SOF increased by roughly 40 percent with B100. This increased SOF is mostly the B100 fuel itself, which at particulate sampling temperatures is likely to condense onto a particulate filter. The increased SOF offset some of the reduction in insolubles, resulting in a net 30 percent reduction in total particulates. Sulfate emissions were essentially eliminated with B100.

B. C_1 to C_{12} Hydrocarbon Speciation

A summary of C_1 to C_{12} speciation data, by individual species, including aldehydes and ketones, is given in Table 5. This table shows the composite brake-specific mass for each hydrocarbon compound, for all of the Cummins N14 tests, on all three fuels. Where "trace" appears on the table, it means that a given compound was detected, but was present at a level below the quantitation limit of the analysis, which was 0.02 mg/hp-hr. A zero on the table indicates that a compound either was not detected, or was found at a level below that of the background. Full details of speciation results for individual tests are given in Appendix C.

TABLE 3. REGULATED TRANSIENT EMISSIONS

Test Number	Test Date	Test Fuel	Transient Emissions, g/hp-hr				BSFC, lb/hp-hr	Work, hp-hr	Ref. Work, hp-hr
			HC	CO	NO_x	PM			
1-B100-C1	11/17/97	B100	0.03	0.56	5.35	0.081	0.450	23.9	24.8
1-B100-H1	11/17/97	B100	0.00	0.40	5.09	0.079	0.426	24.1	24.8
1-B100-H2	11/17/97	B100	0.00	0.38	5.06	0.078	0.417	24.2	24.8
Composite	**C1 + H1**	**B100**	**0.01**	**0.42**	**5.13**	**0.079**	**0.429**	**24.1**	**24.8**
1-B100-C2	11/18/97	B100	0.02	0.51	5.37	0.074	0.458	23.8	25.0
1-B100-H3	11/18/97	B100	0.00	0.40	5.12	0.070	0.419	24.1	25.0
1-B100-H4	11/18/97	B100	0.03	0.35	5.28	0.072	0.418	24.2	25.0
Composite	**C2 + H3**	**B100**	**0.01**	**0.42**	**5.15**	**0.071**	**0.425**	**24.1**	**25.0**
1-B100-C3	11/19/97	B100	0.03	0.54	5.40	0.082	0.454	24.0	25.0
1-B100-H5	11/19/97	B100	0.03	0.37	5.20	0.077	0.441	24.2	25.0
1-B100-H6	11/19/97	B100	0.02	0.36	5.21	0.079	0.420	24.2	25.0
Composite	**C3 + H5**	**B100**	**0.03**	**0.39**	**5.23**	**0.077**	**0.442**	**24.2**	**24.9**
B100 Composite Average			**0.01**	**0.41**	**5.17**	**0.076**	**0.432**	**24.1**	**24.9**
1-2D-C1	11/24/97	2-D	0.21	0.95	4.98	0.119	0.399	26.3	27.2
1-2D-H1	11/24/97	2-D	0.20	0.68	4.50	0.104	0.369	26.8	27.2
1-2D-H2	11/24/97	2-D	0.21	0.66	4.55	0.101	0.377	26.9	27.2
Composite	**C1 + H1**	**2-D**	**0.20**	**0.71**	**4.57**	**0.106**	**0.373**	**26.7**	**27.2**
1-2D-C2	11/25/97	2-D	0.21	0.92	4.86	0.116	0.396	26.6	27.3
1-2D-H3	11/25/97	2-D	0.27	0.71	4.48	0.107	0.387	26.9	27.3
1-2D-H4	11/25/97	2-D	0.23	0.72	4.45	0.105	0.383	27.0	27.3
Composite	**C2 + H3**	**2-D**	**0.26**	**0.74**	**4.53**	**0.108**	**0.388**	**26.8**	**27.3**
1-2D-C3	11/26/97	2-D	0.23	0.90	4.89	0.113	0.394	26.4	27.3
1-2D-H5	11/26/97	2-D	0.23	0.76	4.57	0.104	0.386	26.7	27.3
1-2D-H6	11/26/97	2-D	0.30	0.77	4.54	0.104	0.382	26.9	27.3
Composite	**C3 + H5**	**2-D**	**0.23**	**0.78**	**4.61**	**0.105**	**0.387**	**26.6**	**27.3**
2D Composite Average			**0.23**	**0.75**	**4.57**	**0.106**	**0.383**	**26.7**	**27.3**

TABLE 4. TRANSIENT PARTICULATE COMPOSITION

Test Number	Total PM, g/hp-hr	SOF, g/hp-hr	Insolubles, g/hp-hr	Sulfate, mg/hp-hr
1-B100-C1	0.081	0.067	0.014	1.2
1-B100-H1	0.079	0.068	0.011	0.5
1-B100-H2	0.078	0.078	0.000	0.4
Composite	**0.079**	**0.068**	**0.011**	**0.6**
1-B100-C2	0.074	0.067	0.007	0.5
1-B100-H3	0.070	0.060	0.010	0.4
1-B100-H4	0.072	0.061	0.011	0.3
Composite	**0.071**	**0.061**	**0.010**	**0.4**
1-B100-C3	0.082	0.073	0.008	0.3
1-B100-H5	0.077	0.070	0.007	0.2
1-B100-H6	0.079	0.070	0.010	0.3
Composite	**0.077**	**0.070**	**0.007**	**0.2**
1-2D-C1	0.119	0.057	0.061	4.0
1-2D-H1	0.104	0.048	0.056	2.7
1-2D-H2	0.101	0.050	0.051	2.9
Composite	**0.106**	**0.050**	**0.057**	**2.9**
1-2D-C2	0.116	0.051	0.065	3.5
1-2D-H3	0.107	0.045	0.062	3.2
1-2D-H4	0.105	0.042	0.064	3.2
Composite	**0.108**	**0.046**	**0.062**	**3.2**
1-2D-C3	0.113	0.057	0.056	3.6
1-2D-H5	0.104	0.051	0.053	3.1
1-2D-H6	0.104	0.051	0.053	2.7
Composite	**0.105**	**0.052**	**0.053**	**3.2**

TABLE 5. SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
1	METHANE	0.00	0.93	0.75	0.00	0.00	0.00
2	ETHANE	0.11	0.06	0.08	0.14	0.12	trace
2	ETHYLENE	8.38	8.28	8.26	10.44	10.88	10.46
3	PROPANE	0.00	0.00	0.00	0.00	0.00	0.00
3	PROPYLENE	1.50	1.48	1.43	3.47	3.57	3.51
2	ACETYLENE	1.50	1.49	1.48	1.90	1.95	1.92
3	PROPADIENE	0.00	0.00	0.00	0.00	0.00	0.00
4	BUTANE	0.00	0.00	0.02	0.21	trace	trace
4	TRANS-2-BUTENE	0.00	0.00	0.00	0.16	0.18	0.18
4	1-BUTENE	0.68	0.70	0.73	1.08	1.15	1.11
4	2-METHYLPROPENE (ISOBUTYLENE)	0.20	0.21	0.24	0.94	0.88	0.81
5	2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.00	0.00	0.00	0.00	0.00
3	PROPYNE	0.09	0.00	0.02	0.20	0.19	0.20
4	1,3-BUTADIENE	1.02	1.13	1.22	1.35	1.33	1.29
4	2-METHYLPROPANE (ISOBUTANE)	0.00	0.00	0.02	0.00	0.00	0.00
4	1-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
1	METHANOL	0.00	0.00	0.00	0.00	0.00	0.00
4	CIS-2-BUTENE	0.00	0.00	0.00	0.14	0.12	0.13
5	3-METHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
2	ETHANOL	0.00	0.00	0.00	0.00	0.00	0.00
5	2-METHYLBUTANE (ISOPENTANE)	trace	0.00	0.00	0.02	0.00	0.00
4	2-BUTYNE	0.00	0.00	0.00	0.00	0.00	0.00
5	1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
5	2-METHYL-1-BUTENE	0.00	0.00	0.00	0.04	0.26	0.21
5	PENTANE	0.00	0.05	0.03	0.08	0.10	0.06
5	UNIDENTIFIED C5 OLEFINS	0.00	0.00	0.00	0.00	0.00	0.00
5	2-METHYL-1,3-BUTADIENE	0.00	0.32	0.16	0.00	0.00	0.03
5	TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.03	0.00
6	3,3-DIMETHYL-1-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
5	CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.03	0.22
5	2-METHYL-2-BUTENE	0.00	0.00	0.00	0.00	0.00	0.00
4	TERT-BUTANOL	0.00	0.00	0.00	0.00	0.00	0.00
5	CYCLOPENTADIENE	0.00	0.00	0.00	0.00	0.00	0.00
6	2,2-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	0.00	0.17
5	CYCLOPENTENE	0.00	0.00	0.00	0.00	0.21	0.00

TABLE 5 (CONT'D). SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
6	4-METHYL-1-PENTENE	0.00	0.00	0.00	0.18	0.25	0.00
6	3-METHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
5	CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
6	2,3-DIMETHYLBUTANE	0.00	0.00	0.00	0.00	trace	0.00
5	MTBE	0.00	0.00	0.00	0.00	0.00	0.00
6	4-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	2-METHYLPENTANE	0.00	0.26	0.02	0.25	0.19	0.08
6	4-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	3-METHYLPENTANE	0.00	0.00	0.04	0.25	0.18	0.17
6	2-METHYL-1-PENTENE	0.00	0.00	0.02	0.50	0.51	0.60
6	1-HEXENE	0.00	0.00	0.02	0.50	0.51	0.60
6	HEXANE	0.37	0.38	0.43	0.00	0.03	0.00
6	UNIDENTIFIED C6 OLEFINS	0.00	0.00	0.00	0.00	0.24	0.00
6	TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
6	CIS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
6	DI-ISOPROPYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
6	TRANS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
6	3-METHYL-TRANS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	2-METHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	3-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	CIS-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
6	ETBE	0.00	0.00	0.00	0.00	0.00	0.00
6	3-METHYL-CIS-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	2,2-DIMETHYLPENTANE [a]	0.24	0.30	0.07	0.00	0.00	0.10
6	METHYLCYCLOPENTANE [a]	0.24	0.30	0.07	0.00	0.00	0.09
7	2,4-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.02
7	2,2,3-TRIMETHYLBUTANE	0.00	trace	0.03	0.00	0.00	trace
7	3,4-DIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	1-METHYLCYCLOPENTENE	0.00	0.00	0.00	0.00	0.00	0.00
6	BENZENE	0.93	0.85	0.88	0.82	1.12	0.85
7	3-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
7	3,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.03
6	CYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
7	2-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
7	2,3-DIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 5 (CONT'D). SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
7	1,1-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
6	TERT-AMYL METHYL ETHER	0.00	0.00	0.00	0.00	0.00	0.00
6	CYCLOHEXENE	0.00	0.00	0.24	0.00	0.00	trace
7	3-METHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
7	CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
7	3-ETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.05
7	TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
7	TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.03
7	1-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
8	2,2,4-TRIMETHYLPENTANE	0.26	0.02	0.16	0.48	0.30	0.14
7	2-METHYL-1-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
7	TRANS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	HEPTANE	0.22	0.38	0.41	0.00	0.03	0.07
7	CIS-3-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	UNIDENTIFIED C7	0.00	0.00	0.00	0.00	0.17	0.00
7	2-METHYL-2-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
7	3-METHYL-TRANS-3-HEXENE	0.00	0.00	0.00	0.00	0.00	0.00
7	TRANS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	3-ETHYL-CIS-2-PENTENE	0.00	0.03	0.38	0.00	0.00	0.00
8	2,4,4-TRIMETHYL-1-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	2,3-DIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	CIS-2-HEPTENE	0.00	0.00	0.00	0.00	0.00	0.00
7	METHYLCYCLOHEXANE	0.00	0.00	0.00	0.21	0.24	0.15
7	CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	2,2-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	2,4,4-TRIMETHYL-2-PENTENE	0.00	0.00	0.00	0.00	0.00	0.00
8	2,2,3-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.09
8	2,5-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
7	ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	2,4-DIMETHYLHEXANE	0.00	0.00	0.00	0.04	0.25	0.14
8	1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	3,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	2,3,4-TRIMETHYLPENTANE	0.00	0.03	0.00	0.00	0.11	trace

TABLE 5 (CONT'D). SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
8	2,3,3-TRIMETHYLPENTANE	0.00	0.00	0.00	0.00	0.00	0.04
7	TOLUENE	0.84	0.70	1.08	0.87	0.88	0.63
8	2,3-DIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.23	0.36
8	1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	2-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.18
8	3,4-DIMETHYLHEXANE [b]	0.00	0.00	0.00	0.00	0.00	0.00
8	4-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	3-METHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	3-ETHYLHEXANE	0.00	0.00	0.00	0.00	0.17	0.24
9	2,2,5-TRIMETHYLHEXANE	0.00	0.00	0.19	0.03	0.03	0.30
8	TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.19	0.00	0.00	0.17	0.00
8	CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.37	0.50	0.57
8	1,1-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,4,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,2,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	1-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
8	TRANS-4-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
8	OCTANE	0.00	0.00	0.00	0.29	0.32	0.37
8	UNIDENTIFIED C8	0.00	0.00	0.00	0.00	0.00	0.20
8	TRANS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
8	TRANS-1,3-DIMETHYLCYCLOHEXANE [c]	0.00	0.00	0.00	0.00	0.00	0.00
8	CIS-2-OCTENE	0.00	0.00	0.00	0.00	0.00	0.00
8	ISOPROPYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,2-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,3,5-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
8	CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	4,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 5 (CONT'D). SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
10	1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.00	0.00	0.00	0.03	0.00
10	1-METHYL-3-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
9	1,2,3-TRIMETHYLBENZENE	0.00	0.00	0.00	0.28	0.33	0.00
11	1-METHYL-4-ISOPROPYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
9	INDAN	0.00	0.00	0.00	0.00	0.00	0.00
10	1-METHYL-2-ISOPROPYLBENZENE	0.00	0.00	0.00	0.03	0.04	0.26
10	1,3-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1,4-DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.36	0.22
10	1-METHYL-3-N-PROPYLBENZENE	0.00	0.00	0.00	0.00	0.16	0.00
10	1-METHYL-4-N-PROPYLBENZENE	0.00	0.00	0.00	0.15	0.49	0.26
10	1,2 DIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1-METHYL-2-N-PROPYLBENZENE	0.00	0.00	0.00	0.25	0.26	0.22
10	1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.03	0.44	0.00
10	1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
11	UNDECANE	0.00	0.00	0.00	1.72	2.59	1.93
10	1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	2.19	0.80	0.24
11	2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.00	0.00	0.00	0.00	0.00
11	3,4 DIMETHYLCUMENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1,2,3,5-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.12	0.55	0.30
11	TERT-1-BUT-2-METHYLBENZENE	0.00	0.00	0.00	0.55	0.39	0.42
10	1,2,3,4-TETRAMETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
11	N-PENT-BENZENE	0.00	0.00	0.00	0.59	0.77	0.74
11	TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.00	0.00	0.24	0.39	0.24
12	TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	NAPHTHALENE	0.00	0.00	0.00	0.23	0.25	0.37
12	DODECANE	0.00	0.00	0.00	1.47	1.67	1.74
12	1,3,5-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
12	1,2,4-TRIETHYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
12	HEXYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
	UNIDENTIFIED C9-C12+	0.00	0.00	0.00	3.71	5.33	3.89
1	FORMALDEHYDE	9.49	8.99	8.72	12.86	13.60	13.62

TABLE 5 (CONT'D). SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
8	ETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,6-DIMETHYLHEPTANE [d]	0.00	0.00	0.00	0.60	0.66	0.53
9	1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,5-DIMETHYLHEPTANE [e]	0.00	0.00	0.00	0.22	0.25	0.25
9	3,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	3,5-DIMETHYLHEPTANE [e]	0.00	0.00	0.00	0.00	0.00	0.00
8	ETHYLBENZENE	0.00	0.00	0.00	0.69	0.79	0.88
9	2,3,4-TRIMETHYLHEXANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2,3-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
8	m-& p-XYLENE	0.00	0.00	0.00	0.96	0.94	1.15
9	4-METHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	3,4-DIMETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	4-ETHYLHEPTANE	0.00	0.00	0.00	0.00	0.00	0.00
9	2-METHYLOCTANE	0.00	0.00	0.00	0.29	0.30	0.36
9	3-METHYLOCTANE	0.00	0.00	0.00	0.23	0.26	0.27
8	STYRENE	0.00	0.00	0.00	0.00	0.00	0.00
8	o-XYLENE	0.00	0.00	0.00	0.39	0.37	0.47
8	1-NONENE	0.00	0.00	0.00	0.06	0.25	0.35
9	TRANS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
9	CIS-3-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
8	NONANE	0.00	0.00	0.00	0.69	0.75	0.80
9	TRANS-2-NONENE	0.00	0.00	0.00	0.00	0.00	0.00
8	ISOPROPYLBENZENE (CUMENE)	0.00	0.00	0.00	0.15	0.03	0.30
10	2,2-DIMETHYLOCTANE	0.00	0.00	0.00	0.00	0.00	0.00
10	2,4-DIMETHYLOCTANE	0.00	0.00	0.00	0.29	0.29	0.36
9	n-PROPYLBENZENE	0.00	0.00	0.00	0.33	0.20	0.37
9	1-METHYL-3-ETHYLBENZENE	0.00	0.00	0.00	0.23	0.52	0.51
9	1-METHYL-4-ETHYLBENZENE	0.00	0.00	0.00	0.30	0.38	0.34
9	1,3,5-TRIMETHYLBENZENE	0.00	0.00	0.00	0.42	0.43	0.42
9	1-METHYL-2-ETHYLBENZENE	0.00	0.00	0.00	0.42	0.40	0.40
9	1,2,4-TRIMETHYLBENZENE	0.00	0.00	0.00	0.07	0.76	0.58
10	TERT-BUTYLBENZENE	0.00	0.00	0.00	0.00	0.00	0.00
10	1-DECENE	0.00	0.00	0.00	0.00	0.00	0.00
10	DECANE [f]	0.00	0.00	0.00	0.52	0.50	0.47
10	ISOBUTYLBENZENE [f]	0.00	0.00	0.00	0.49	0.47	0.44

TABLE 5 (CONT'D). SUMMARY OF COMPOSITE C_1 TO C_{12} SPECIATION

CARBON NO.	COMPOUND	Composite Brake Specific Mass, mg/hp-hr					
		B100			2D		
		1	2	3	1	2	3
2	ACETALDEHYDE	3.07	3.05	3.04	4.78	4.61	4.86
3	ACROLEIN	2.16	2.76	2.54	1.65	1.15	1.52
3	ACETONE	0.69	0.52	0.51	1.40	1.41	1.38
3	PROPIONALDEHYDE	1.79	1.40	1.04	1.23	2.53	2.35
4	CROTONALDEHYDE	0.96	0.64	0.81	1.67	2.29	1.87
4	ISOBUTYRALDEHYDE [h]	0.32	0.38	0.29	0.41	0.52	0.56
4	METHYL ETHYL KETONE [h]	0.32	0.38	0.29	0.41	0.52	0.56
7	BENZALDEHYDE	0.04	0.00	0.00	0.56	0.47	0.82
5	ISOVALERALDEHYDE	0.54	0.82	0.63	0.60	0.24	0.29
5	VALERALDEHYDE	0.27	0.33	0.16	0.36	0.36	0.45
8	O-TOLUALDEHYDE	0.37	0.49	0.31	0.34	0.32	0.40
8	M/P-TOLUALDEHYDE	1.30	1.41	1.62	2.07	1.87	1.67
6	HEXANALDEHYDE	1.08	0.90	0.90	0.46	0.36	0.35
9	DIMETHYLBENZALDEHYDE	0.00	0.00	0.00	0.26	0.47	0.23
SUMMED SPECIATED VALUES		39	40	39	73	82	77

a 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
b 3-Methyl-3-ethyl-pentane co-elutes with reported compound. Not reported separately.
c Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
d Propylcyclopentane co-elutes with reported compound. Not reported separately.
e 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
f Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
g n-Butylbenzene co-elutes with reported compound. Not reported separately.
h Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

A summary of total speciated hydrocarbons, and their associated ozone formation potential,[2] is shown in Figure 2. For neat B100, the total speciated hydrocarbon mass is nearly 50 percent less than that measured for 2D fuel, and the associated ozone potential is reduced by the same amount. Significant reductions in most of the aldehyde compounds were observed with B100, with formaldehyde and acetaldehyde 30 percent lower than the levels observed for 2D fuel. A summary of alcohol data is given in Table 6. None of the target alcohols were found at a quantifiable level in any of the samples from the Cummins N14 engine, and the few traces detected were at levels below those found in the background samples. This was expected, as no alcohol was present in any of the test fuels.

C. PAH and nPAH

A summary of the results of PAH and nPAH analyses for all three fuels is given in Table 7. This table shows the total composite emission rate of each PAH/nPAH compound, including both particulate and semivolatile phases. Complete PAH/nPAH data for individual samples is given in Appendix D. Where an "nd" appears, it means the compound was not detected in any of the exhaust samples for that test fuel and day. The only "nds" that occurred were for selected nPAH compounds on certain biodiesel test runs. The detection limits for these compounds were actually below 0.1 ng/hp-hr for filter samples, and below 0.05 ng/hp-hr for the PUF/XAD-2 samples. Where "trace" appears in the table, it means that the compound was detected, but was measured at a level below the required quantitation limit of 0.5 ng/hp-hr, as defined by EPA in CFR Title 40 Part 79. Where a zero appears in Appendix D for a given compound and exhaust sample, it means that this compound was detected and quantified, but at a level lower than in the background samples, resulting in a calculated mass less than zero in these cases. Any calculated masses less than zero were set to zero following what is standard practice for regulated emissions calculations. This only occurred for certain compounds on selected semivolatile samples.

The neat B100 samples presented a unexpected problem for the analysis, in that the biodiesel fuel itself caused considerable interference during the PAH analysis. The nPAH measurement was not affected by this because those compounds are measured with the GC/MS in a negative ion mode, rather than the positive ion mode used for PAHs. Several cleaning processes were attempted in an effort to remove the interfering biodiesel compounds, but this was only partially successful. A number of biodiesel samples had to be diluted as much as 50-fold, although all PAHs were still detected, so detection thresholds did not become an issue. The PUF/XAD-2 samples were cleaned, diluted, and then analyzed using a higher resolution instrument in order to achieve required detection capabilities. Again, all of the PAH compounds were detected in these samples, so detection thresholds were not an issue.

The neat B100 fuel resulted in large decreases in all of the target PAH and nPAH compounds, as compared to 2D fuel. All of the PAH compounds were reduced by 75 to 85 percent, with the exception of benzo(a)anthracene, which was reduced by roughly 50 percent. The target nPAH compounds were also reduced dramatically with neat B100 fuel, with 2-nitrofluorene and 1-nitropyrene reduced by 90 percent, and the rest of the nPAH compounds

[2]Calculated based on reactivity factors given in "California Non-Methane Organic Gas Test Procedures Appendix 1 - List of Target Compounds."

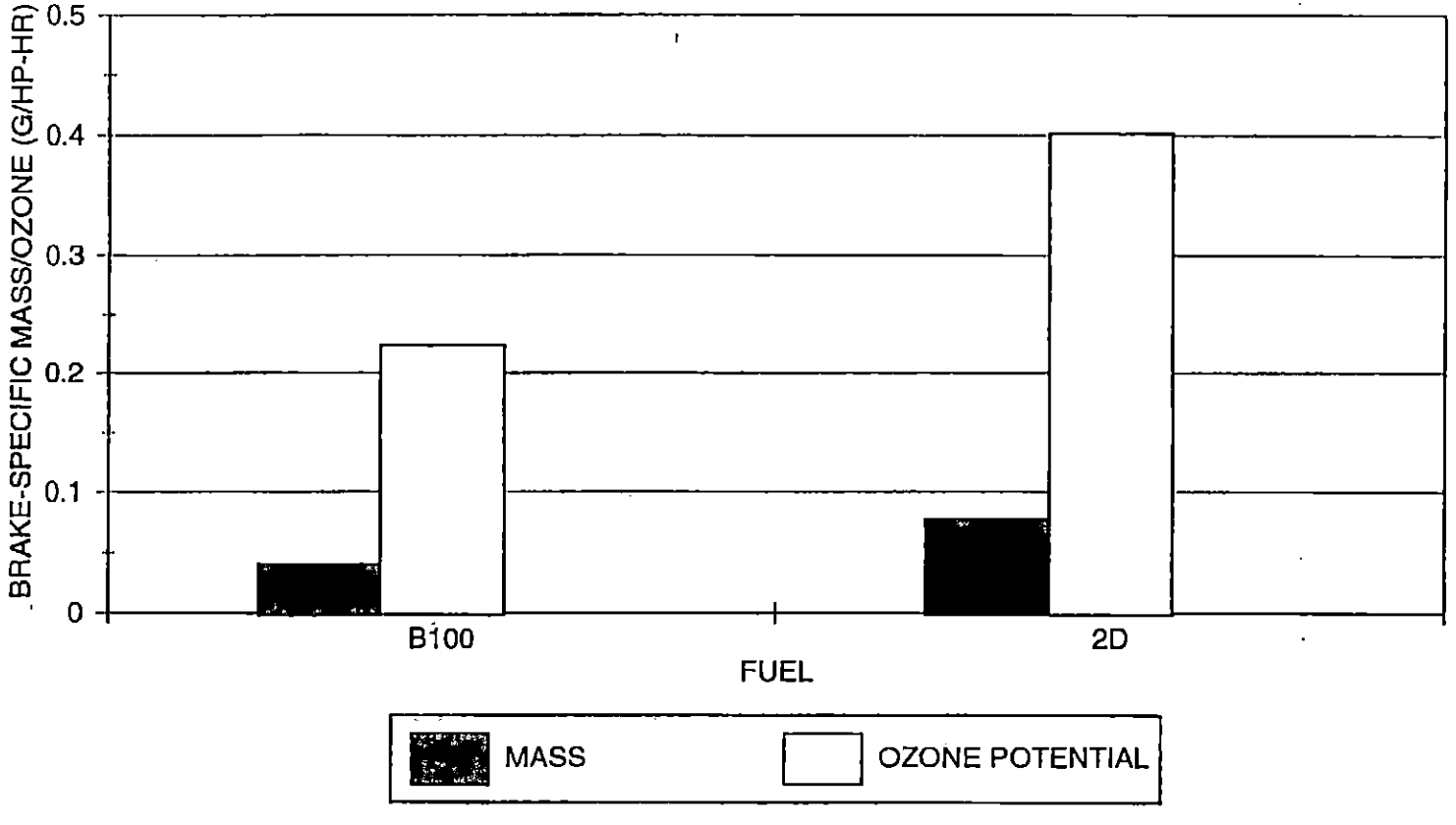

FIGURE 2. COMPOSITE TOTAL MASS AND OZONE POTENTIAL FROM C_1 TO C_{12} SPECIATION ANALYSIS

reduced to only trace levels. All of these reductions are likely due to the fact the biodiesel fuel contained no aromatic compounds of any kind, including PAHs.

TABLE 6. SUMMARY OF COMPOSITE ALCOHOL DATA

Compound	B100			2D		
	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
methanol	0.0	nd	0.0	0.0	0.0	nd
ethanol	nd	nd	nd	nd	nd	nd
t-butanol	0.0	nd	nd	nd	nd	nd
2-propanol	nd	nd	nd	nd	nd	nd
1-propanol	0.0	nd	nd	nd	nd	nd
nd - not detected						

TABLE 7. SUMMARY OF PAH/nPAH DATA

	B100				2D			
	Day 1	Day 2	Day 3	Average	Day 1	Day 2	Day 3	Average
ng/hp-hr PAH								
Benzo(a)anthracene	1187	1212	2267	1555	3318	4193	2418	3309
Chrysene	436	757	561	585	3950	4956	3055	3987
Benzo(b)fluoranthene	383	437	511	443	1478	2060	1351	1629
Benzo(k)fluoranthene	318	386	445	383	2002	2207	1209	1806
Benzo(a)pyrene	196	250	247	231	1464	1868	973	1435
Indeno(1.2,3-cd)pyrene	173	206	235	205	883	1194	672	916
Dibenz(a,h)anthracene	48	55	82	62	310	398	236	315
Benzo(g,h,i)perylene	209	201	299	236	1251	1616	889	1252
ng/hp-hr nPAH								
2-Nitrofluorene	6.5	8.5	13	9.4	131	106	133	123
1-Nitropyrene	6.3	4.7	6.4	5.8	63	84	99	82
7-Nitrobenz(a)anthracene	trace	trace	trace	trace	2.5	1.4	1.8	1.9
6-Nitrochrysene	trace	trace	trace	trace	0.6	0.8	0.9	0.8
6-Nitrobenz(a)pyrene	nd	trace	nd	trace	3.5	2.5	1.5	2.5

IV. CONCLUSIONS

In considering all of the data from the Cummins N14, several trends become apparent in comparing the two test fuels. For regulated emissions, the neat biodiesel fuel (B100) reduced emissions of HC, CO, and particulates by 95, 45, and 30 percent, respectively, as compared to 2D fuel. NO_x emissions, however, increased 13 percent with B100 fuel. The reduction in particulate emissions with neat biodiesel was generally due to a reduction in carbon soot, although this was partially offset by an increase in SOF.

When the unregulated emissions data is examined, the results generally indicate substantial improvements with neat biodiesel. The mass of speciated hydrocarbons from C_1 to C_{12} is reduced significantly with neat biodiesel, compared to diesel fuel, as is the ozone formation potential of the hydrocarbon emissions. Substantial reductions in aldehydes such as formaldehyde and acetaldehyde were observed with neat biodiesel. PAH and nPAH data also indicated reductions on the order of 90 percent with neat biodiesel for nearly all of the PAHs and nPAHs that were measured.

APPENDIX A

CUMMINS N14 DURABILITY CYCLE

CUMMINS N14 DURABILITY CYCLE

Step	Condition	Speed, rpm	Throttle	Time, sec
1	Idle	650	Closed	144
2	Peak Torque	1200	WOT	36
3	Rated Power	1800	WOT	360
4	High Idle	2000	WOT	36
5	Rated Power	1800	WOT	144
6	Ramp to Peak Torque	Ramp to 1200	WOT	36
7	Peak Torque	1200	WOT	108
8	High Idle	3000	WOT	36

APPENDIX B

INDIVIDUAL TRANSIENT TEST DATA

Southwest Research Institute - Department of Emissions Research
EPA Cold Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-C1
Date: 11/07/1997 Time: 09:43
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.833 FID Resp: 1.00
H= 0.120 C= 0.780 O= 0.100 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.55	in Hg	100.1 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	53.1	°F	11.7 °C
Abs. Humidity:	61.0	gr/lb	8.7 g/kg
Rel. Humidity:	46	%	
Dilution Air:			
Temperature:	74.0	°F	23.3 °C
Abs. Humidity	33.9	gr/lb	4.8 g/kg
Rel. Humidity:	27	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.01	ppm	
HC Bckgrd	n/a		3.14	ppm	
CO Sample	9.9	2	9.46	ppm	
CO Bckgrd	0.4	2	0.38	ppm	
NOx Sample	n/a		54.45	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	73.8	1	0.6309	%	
CO2 Bckgrd	7.8	1	0.0455	%	

Corrected Concentrations

HC	1.01	ppm
CO	8.90	ppm
NOx	53.62	ppm
CO2	0.5875	%

Mass Emissions

HC	0.755	grams	
CO	13.412	grams	
NOx	127.996	grams	
Particulate	1.946	grams	
CO2	13.906	kg	
Fuel	10.75 lb	4.87	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,189.0	61.99
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.60	0.05
Gas Meter 2:	3.01	0.09
Sample Rate:	1.41	0.04
20X20 Sample Rate:	50.64	1.43
47 mm Sample Rate:	29.28	0.83
Chemistry Sample Rate:	2.63	0.07
Total Flow Rate:	2,272.95	64.37

Particulate Data

Filter Number:	8932.1 (pair)
Weight Gain, mg:	1.209
Sample Multiplier:	1.610

Correction Factors

NOx Humidity CF:	0.965
Dry-to-Wet CF, Sample:	0.986
Dry-to-Wet CF, Bckgrd:	0.992
Dilution Factor:	21.91

Test Cycle Data

Sample Time:	1,207.40	sec		
Work:	23.91	hp-hr	17.83	kW-hr
Reference Work:	24.82	hp-hr	18.51	kW-hr
Total Volume (Vmix):	45,686.4	scf	1,293.87	scm

Brake-Specific Emission Results

BSHC (Cell)	0.032	g/hp-hr	0.042	g/kW-hr
CO	0.561	g/hp-hr	0.752	g/kW-hr
NOx (Cell)	5.353	g/hp-hr	7.179	g/kW-hr
Particulate	0.081	g/hp-hr	0.109	g/kW-hr
CO2	581.6	g/hp-hr	779.91	g/kW-hr
BSFC	0.450	lb/hp-hr	0.273	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-H1
Date: 11/17/1997 Time: 10:23
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.833 FID Resp: 1.00
H= 0.120 C= 0.780 O= 0.100 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.54	in Hg	100.0 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	54.2	°F	12.3 °C
Abs. Humidity:	63.5	gr/lb	9.1 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	75.0	°F	23.9 °C
Abs. Humidity	32.3	gr/lb	4.6 g/kg
Rel. Humidity:	25	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.05	ppm	
HC Bckgrd	n/a		4.07	ppm	
CO Sample	7.0	2	6.67	ppm	
CO Bckgrd	0.2	2	0.19	ppm	
NOx Sample	n/a		52.08	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	71.9	1	0.6076	%	
CO2 Bckgrd	7.8	1	0.0455	%	

Corrected Concentrations

HC	0.16	ppm
CO	6.36	ppm
NOx	51.31	ppm
CO2	0.5641	%

Mass Emissions

HC		0.118	grams
CO		9.549	grams
NOx		122.908	grams
Particulate		1.908	grams
CO2		13.312	kg
Fuel	10.28 lb	4.66	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,181.5	61.78
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.05
Gas Meter 2:	3.01	0.09
Sample Rate:	1.41	0.04
20X20 Sample Rate:	50.53	1.43
47 mm Sample Rate:	29.41	0.83
Chemistry Sample Rate:	2.67	0.08
Total Flow Rate:	2,265.56	64.16

Particulate Data

Filter Number:	8933.0-2 (pair)
Weight Gain, mg:	1.193
Sample Multiplier:	1.600

Correction Factors

NOx Humidity CF:	0.971
Dry-to-Wet CF, Sample:	0.987
Dry-to-Wet CF, Bckgrd:	0.993
Dilution Factor:	22.76

Test Cycle Data

Sample Time:	1,207.70	sec		
Work:	24.13	hp-hr	17.99	kW-hr
Reference Work:	24.82	hp-hr	18.51	kW-hr
Total Volume (Vmix):	45,548.2	scf	1,289.95	scm

Brake-Specific Emission Results

BSHC (Cell)	0.005	g/hp-hr	0.007	g/kW-hr
CO	0.396	g/hp-hr	0.531	g/kW-hr
NOx (Cell)	5.094	g/hp-hr	6.831	g/kW-hr
Particulate	0.079	g/hp-hr	0.106	g/kW-hr
CO2	551.7	g/hp-hr	739.81	g/kW-hr
BSFC	0.426	lb/hp-hr	0.259	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-H2
Date: 11/17/1997 Time: 11:03
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.833 FID Resp: 1.00
H= 0.120 C= 0.780 O= 0.100 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.53	in Hg	100.0 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	54.5	°F	12.5 °C
Abs. Humidity:	64.3	gr/lb	9.2 g/kg
Rel. Humidity:	49	%	
Dilution Air:			
Temperature:	75.0	°F	23.9 °C
Abs. Humidity	32.3	gr/lb	4.6 g/kg
Rel. Humidity:	25	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.39	ppm	
HC Bckgrd	n/a		4.63	ppm	
CO Sample	6.9	2	6.57	ppm	
CO Bckgrd	0.4	2	0.38	ppm	
NOx Sample	n/a		52.17	ppm	(Dry)
NOx Bckgrd	0.2	2	0.20	ppm	
CO2 Sample	71.3	1	0.6003	%	
CO2 Bckgrd	7.8	1	0.0455	%	

Corrected Concentrations

HC	-0.04	ppm
CO	6.08	ppm
NOx	51.31	ppm
CO2	0.5568	%

Mass Emissions

HC		0.000	grams
CO		9.094	grams
NOx		122.609	grams
Particulate		1.877	grams
CO2		13.084	kg
Fuel	10.11 lb	4.58	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,171.4	61.49
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.05
Gas Meter 2:	3.03	0.09
Sample Rate:	1.44	0.04
20X20 Sample Rate:	50.62	1.43
47 mm Sample Rate:	29.75	0.84
Total Flow Rate:	2,253.19	63.81

Particulate Data

Filter Number:	8934.0-3 (pair)
Weight Gain, mg:	1.200
Sample Multiplier:	1.564

Correction Factors

NOx Humidity CF:	0.973
Dry-to-Wet CF, Sample:	0.987
Dry-to-Wet CF, Bckgrd:	0.993
Dilution Factor:	23.03

Test Cycle Data

Sample Time:	1,207.80	sec		
Work:	24.22	hp-hr	18.06	kW-hr
Reference Work:	24.82	hp-hr	18.51	kW-hr
Total Volume (Vmix):	45,356.7	scf	1,284.53	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.000 g/hp-hr	0.000	g/kW-hr
CO		0.375 g/hp-hr	0.504	g/kW-hr
NOx	(Cell)	5.062 g/hp-hr	6.789	g/kW-hr
Particulate		0.078 g/hp-hr	0.104	g/kW-hr
CO2		540.2 g/hp-hr	724.43	g/kW-hr
BSFC		0.417 lb/hp-hr	0.254	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Cold Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-C2
Date: 11/18/1997 Time: 09:30
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.833 FID Resp: 1.00
H= 0.120 C= 0.760 O= 0.100 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.35	in Hg	99.4 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	54.2	°F	12.3 °C
Abs. Humidity:	64.0	gr/lb	9.1 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	59.8	gr/lb	8.5 g/kg
Rel. Humidity:	42	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.53	ppm	
HC Bckgrd	n/a		3.96	ppm	
CO Sample	9.5	2	9.07	ppm	
CO Bckgrd	0.8	2	0.76	ppm	
NOx Sample	n/a		54.88	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	75.1	1	0.6471	%	
CO2 Bckgrd	8.1	1	0.0473	%	

Corrected Concentrations

HC	0.76	ppm
CO	8.12	ppm
NOx	53.71	ppm
CO2	0.6020	%

Mass Emissions

HC		0.558	grams	
CO		12.116	grams	
NOx		127.990	grams	
Particulate		1.773	grams	
CO2		14.117	kg	
Fuel	10.91	lb	4.95	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,173.0	61.54
Blower 2 Rate:	0.0	0.00
90 mm System:		-
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.94	0.08
Sample Rate:	1.36	0.04
20X20 Sample Rate:	49.93	1.41
47 mm Sample Rate:	24.41	0.69
Chemistry Sample Rate:	2.59	0.07
Total Flow Rate:	2,251.25	63.76

Particulate Data

Filter Number:	8935.0-4 (pair)
Weight Gain, mg:	1.072
Sample Multiplier:	1.654

Correction Factors

NOx Humidity CF:	0.972
Dry-to-Wet CF, Sample:	0.980
Dry-to-Wet CF, Bckgrd:	0.986
Dilution Factor:	21.36

Test Cycle Data

Sample Time:	1,207.70	sec		
Work:	23.84	hp-hr	17.78	kW-hr
Reference Work:	25.03	hp-hr	18.66	kW-hr
Total Volume (Vmix):	45,261.7	scf	1,281.84	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.023 g/hp-hr	0.031	g/kW-hr
CO		0.508 g/hp-hr	0.682	g/kW-hr
NOx	(Cell)	5.369 g/hp-hr	7.200	g/kW-hr
Particulate		0.074 g/hp-hr	0.100	g/kW-hr
CO2		592.2 g/hp-hr	794.11	g/kW-hr
BSFC		0.458 lb/hp-hr	0.278	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-H3
Date: 11/18/1997 Time: 10:10
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.833 FID Resp: 1.00
H= 0.120 C= 0.780 O= 0.100 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.35	in Hg	99.4 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	55.4	°F	13.0 °C
Abs. Humidity:	66.8	gr/lb	9.5 g/kg
Rel. Humidity:	51	%	
Dilution Air:			
Temperature:	78.0	°F	25.6 °C
Abs. Humidity	53.5	gr/lb	7.6 g/kg
Rel. Humidity:	37	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.37	ppm	
HC Bckgrd	n/a		4.47	ppm	
CO Sample	7.4	2	7.05	ppm	
CO Bckgrd	0.4	2	0.38	ppm	
NOx Sample	n/a		52.48	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	71.5	1	0.6027	%	
CO2 Bckgrd	7.9	1	0.0461	%	

Corrected Concentrations

HC	0.09	ppm
CO	6.53	ppm
NOx	51.45	ppm
CO2	0.5586	%

Mass Emissions

HC		0.070	grams	
CO		9.736	grams	
NOx		123.483	grams	
Particulate		1.697	grams	
CO2		13.096	kg	
Fuel	10.12	lb	4.59	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,173.2	61.55
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.95	0.08
Sample Rate:	1.38	0.04
20X20 Sample Rate:	49.47	1.40
47 mm Sample Rate:	23.32	0.66
Chemistry Sample Rate:	2.61	0.07
Total Flow Rate:	2,249.93	63.72

Particulate Data

Filter Number:	8954.0-9 (pair)
Weight Gain, mg:	1.039
Sample Multiplier:	1.633

Correction Factors

NOx Humidity CF:	0.979
Dry-to-Wet CF, Sample:	0.982
Dry-to-Wet CF, Bckgrd:	0.988
Dilution Factor:	22.94

Test Cycle Data

Sample Time:	1,208.10	sec		
Work:	24.14	hp-hr	18.00	kW-hr
Reference Work:	25.03	hp-hr	18.66	kW-hr
Total Volume (Vmix):	45,249.9	scf	1,281.50	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.003 g/hp-hr	0.004	g/kW-hr
CO		0.403 g/hp-hr	0.541	g/kW-hr
NOx	(Cell)	5.115 g/hp-hr	6.860	g/kW-hr
Particulate		0.070 g/hp-hr	0.094	g/kW-hr
CO2		542.5 g/hp-hr	727.51	g/kW-hr
BSFC		0.419 lb/hp-hr	0.255	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-H4
Date: 11/18/1997 Time: 10:50
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.833 FID Resp: 1.00
H= 0.120 C= 0.780 O= 0.100 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.34	in Hg	99.3 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	55.1	°F	12.8 °C
Abs. Humidity:	66.1	gr/lb	9.4 g/kg
Rel. Humidity:	50	%	
Dilution Air:			
Temperature:	78.0	°F	25.6 °C
Abs. Humidity	53.5	gr/lb	7.6 g/kg
Rel. Humidity:	37	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.35	ppm	
HC Bckgrd	n/a		3.42	ppm	
CO Sample	6.5	2	6.19	ppm	
CO Bckgrd	0.4	2	0.38	ppm	
NOx Sample	n/a		54.32	ppm	(Dry)
NOx Bckgrd	n/a	2	0.00	ppm	
CO2 Sample	71.6	1	0.6040	%	
CO2 Bckgrd	8.0	1	0.0467	%	

Corrected Concentrations

HC	1.08	ppm
CO	5.69	ppm
NOx	53.36	ppm
CO2	0.5593	%

Mass Emissions

HC		0.796	grams
CO		8.476	grams
NOx		127.715	grams
Particulate		1.747	grams
CO2		13.103	kg
Fuel	10.12 lb	4.59	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,172.3	61.52
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.91	0.08
Sample Rate:	1.33	0.04
20X20 Sample Rate:	49.24	1.39
47 mm Sample Rate:	23.82	0.67
Total Flow Rate:	2,246.66	63.63

Particulate Data

Filter Number:	8959.0-11 (pair)
Weight Gain, mg:	1.035
Sample Multiplier:	1.688

Correction Factors

NOx Humidity CF:	0.977
Dry-to-Wet CF, Sample:	0.982
Dry-to-Wet CF, Bckgrd:	0.988
Dilution Factor:	22.90

Test Cycle Data

Sample Time:	1,207.50	sec		
Work:	24.20	hp-hr	18.05	kW-hr
Reference Work:	25.03	hp-hr	18.66	kW-hr
Total Volume (Vmix):	45,214.0	scf	1,280.49	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.033 g/hp-hr	0.044	g/kW-hr
CO		0.350 g/hp-hr	0.470	g/kW-hr
NOx	(Cell)	5.277 g/hp-hr	7.077	g/kW-hr
Particulate		0.072 g/hp-hr	0.097	g/kW-hr
CO2		541.4 g/hp-hr	726.08	g/kW-hr
BSFC		0.418 lb/hp-hr	0.254	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Cold Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-C3
Date: 11/19/1997 Time: 09:09
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.821 FID Resp: 1.00
H= 0.118 C= 0.772 O= 0.110 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.40	in Hg	99.5 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	55.3	°F	12.9 °C
Abs. Humidity:	66.5	gr/lb	9.5 g/kg
Rel. Humidity:	50	%	
Dilution Air:			
Temperature:	75.0	°F	23.9 °C
Abs. Humidity	63.0	gr/lb	9.0 g/kg
Rel. Humidity:	48	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.65	ppm	
HC Bckgrd	n/a		3.72	ppm	
CO Sample	11.2	2	10.72	ppm	
CO Bckgrd	2.0	2	1.89	ppm	
NOx Sample	n/a		54.89	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	74.3	1	0.6371	%	
CO2 Bckgrd	8.2	1	0.0479	%	

Corrected Concentrations

HC	1.10	ppm
CO	8.65	ppm
NOx	53.69	ppm
CO2	0.5914	%

Mass Emissions

HC		0.815	grams
CO		12.958	grams
NOx		129.277	grams
Particulate		1.955	grams
CO2		13.924	kg
Fuel	10.87 lb	4.93	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,183.4	61.84
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.04
Gas Meter 2:	2.95	0.08
Sample Rate:	1.36	0.04
20X20 Sample Rate:	49.45	1.40
47 mm Sample Rate:	23.97	0.68
Chemistry Sample Rate:	2.54	0.07
Total Flow Rate:	2,260.75	64.03

Particulate Data

Filter Number:	8975.0-19 (pair)
Weight Gain, mg:	1.179
Sample Multiplier:	1.658

Correction Factors

NOx Humidity CF:	0.978
Dry-to-Wet CF, Sample:	0.980
Dry-to-Wet CF, Bckgrd:	0.986
Dilution Factor:	21.80

Test Cycle Data

Sample Time:	1,207.40	sec		
Work:	23.96	hp-hr	17.87	kW-hr
Reference Work:	24.95	hp-hr	18.61	kW-hr
Total Volume (Vmix):	45,442.6	scf	1,286.96	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.034 g/hp-hr	0.046	g/kW-hr
CO		0.541 g/hp-hr	0.725	g/kW-hr
NOx	(Cell)	5.396 g/hp-hr	7.236	g/kW-hr
Particulate		0.082 g/hp-hr	0.109	g/kW-hr
CO2		581.1 g/hp-hr	779.30	g/kW-hr
BSFC		0.454 lb/hp-hr	0.276	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-H5
Date: 11/19/1997 Time: 09:49
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.821 FID Resp: 1.00
H= 0.118 C= 0.772 O= 0.110 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.40	in Hg	99.6 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	54.2	°F	12.3 °C
Abs. Humidity:	63.8	gr/lb	9.1 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	76.0	°F	24.4 °C
Abs. Humidity	56.7	gr/lb	8.1 g/kg
Rel. Humidity:	42	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.55	ppm	
HC Bckgrd	n/a		3.87	ppm	
CO Sample	7.5	2	7.15	ppm	
CO Bckgrd	1.1	2	1.04	ppm	
NOx Sample	n/a		53.75	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	73.5	1	0.6272	%	
CO2 Bckgrd	8.4	1	0.0492	%	

Corrected Concentrations

HC	0.85	ppm
CO	5.99	ppm
NOx	52.65	ppm
CO2	0.5802	%

Mass Emissions

HC		0.633	grams
CO		8.976	grams
NOx		125.978	grams
Particulate		1.858	grams
CO2		13.666	kg
Fuel	10.67 lb	4.84	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,184.0	61.85
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.04
Gas Meter 2:	2.95	0.08
Sample Rate:	1.36	0.04
20X20 Sample Rate:	49.18	1.39
47 mm Sample Rate:	23.59	0.67
Chemistry Sample Rate:	2.59	0.07
Total Flow Rate:	2,260.74	64.03

Particulate Data

Filter Number:	8976.0-20 (pair)
Weight Gain, mg:	1.122
Sample Multiplier:	1.656

Correction Factors

NOx Humidity CF:	0.972
Dry-to-Wet CF, Sample:	0.981
Dry-to-Wet CF, Bckgrd:	0.987
Dilution Factor:	22.16

Test Cycle Data

Sample Time:	1,207.90	sec		
Work:	24.21	hp-hr	18.05	kW-hr
Reference Work:	24.95	hp-hr	18.61	kW-hr
Total Volume (Vmix):	45,460.3	scf	1,287.46	scm

Brake-Specific Emission Results

BSHC (Cell)	0.026	g/hp-hr	0.035	g/kW-hr
CO	0.371	g/hp-hr	0.497	g/kW-hr
NOx (Cell)	5.204	g/hp-hr	6.978	g/kW-hr
Particulate	0.077	g/hp-hr	0.103	g/kW-hr
CO2	564.5	g/hp-hr	756.97	g/kW-hr
BSFC	0.441	lb/hp-hr	0.268	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
SME

Test No.: 1-SME-H6
Date: 11/19/1997 Time: 10:29
Program HDT: 4.01-R
Cell: 4 Bag Cart: 1

DIESEL SME, EM-2481-F
HCR: 1.821 FID Resp: 1.00
H= 0.118 C= 0.772 O= 0.110 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.41	in Hg	99.6 kPa
Engine Inlet Air			
Temperature:	76.0	°F	24.4 °C
Dew Point:	55.1	°F	12.8 °C
Abs. Humidity:	66.0	gr/lb	9.4 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	76.0	°F	24.4 °C
Abs. Humidity	56.7	gr/lb	8.1 g/kg
Rel. Humidity:	42	%	

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,180.9	61.77
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.91	0.08
Sample Rate:	1.32	0.04
20X20 Sample Rate:	49.24	1.39
47 mm Sample Rate:	24.19	0.69
Total Flow Rate:	2,255.70	63.88

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		4.97	ppm	
HC Bckgrd	n/a		4.43	ppm	
CO Sample	7.6	2	7.24	ppm	
CO Bckgrd	1.3	2	1.23	ppm	
NOx Sample	n/a		53.66	ppm	(Dry)
NOx Bckgrd	0.1	2	0.10	ppm	
CO2 Sample	71.8	1	0.6064	%	
CO2 Bckgrd	9.2	1	0.0541	%	

Particulate Data

Filter Number:	8977.0-21 (pair)
Weight Gain, mg:	1.126
Sample Multiplier:	1.705

Correction Factors

NOx Humidity CF:	0.977
Dry-to-Wet CF, Sample:	0.982
Dry-to-Wet CF, Bckgrd:	0.987
Dilution Factor:	22.92

Corrected Concentrations

HC	0.73	ppm
CO	5.90	ppm
NOx	52.57	ppm
CO2	0.5547	%

Test Cycle Data

Sample Time:	1,207.60	sec		
Work:	24.23	hp-hr	18.07	kW-hr
Reference Work:	24.95	hp-hr	18.61	kW-hr
Total Volume (Vmix):	45,399.7	scf	1,285.75	scm

Mass Emissions

HC	0.543	grams	
CO	8.829	grams	
NOx	126.312	grams	
Particulate	1.920	grams	
CO2	13.046	kg	
Fuel	10.18 lb	4.62	kg

Brake-Specific Emission Results

BSHC	(Cell)	0.022 g/hp-hr	0.030	g/kW-hr
CO		0.364 g/hp-hr	0.489	g/kW-hr
NOx	(Cell)	5.213 g/hp-hr	6.991	g/kW-hr
Particulate		0.079 g/hp-hr	0.106	g/kW-hr
CO2		538.4 g/hp-hr	722.06	g/kW-hr
BSFC		0.420 lb/hp-hr	0.256	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Cold Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-C1
Date: 11/24/1997 Time: 01:06
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.32	in Hg	99.3 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	55.8	°F	13.2 °C
Abs. Humidity:	67.9	gr/lb	9.7 g/kg
Rel. Humidity:	51	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	55.3	gr/lb	7.9 g/kg
Rel. Humidity:	39	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		12.32	ppm	
HC Bckgrd	n/a		5.00	ppm	
CO Sample	17.6	2	17.83	ppm	
CO Bckgrd	0.9	2	0.95	ppm	
NOx Sample	n/a	-	55.44	ppm	(Dry)
NOx Bckgrd	0.6	2	0.60	ppm	
CO2 Sample	76.8	1	0.6866	%	
CO2 Bckgrd	8.7	1	0.0534	%	

Corrected Concentrations

HC	7.57	ppm
CO	16.48	ppm
NOx	53.83	ppm
CO2	0.6359	%

Mass Emissions

HC		5.551	grams
CO		24.481	grams
NOx		128.972	grams
Particulate		3.066	grams
CO2		14.843	kg
Fuel	10.32 lb	4.68	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,168.8	61.42
Blower 2 Rate:	0.0	0.00
90 mm System:		-
Gas Meter 1:	1.59	0.04
Gas Meter 2:	2.87	0.08
Sample Rate:	1.28	0.04
20X20 Sample Rate:	48.04	1.36
47 mm Sample Rate:	19.96	0.57
Chemistry Sample Rate:	2.56	0.07
Total Flow Rate:	2,240.61	63.46

Particulate Data

Filter Number:	9002.0-33 (pair)
Weight Gain, mg:	1.755
Sample Multiplier:	1.747

Correction Factors

NOx Humidity CF:	0.982
Dry-to-Wet CF, Sample:	0.981
Dry-to-Wet CF, Bckgrd:	0.987
Dilution Factor:	19.74

Test Cycle Data

Sample Time:	1,207.80	sec		
Work:	26.33	hp-hr	19.63	kW-hr
Reference Work:	27.24	hp-hr	20.31	kW-hr
Total Volume (Vmix):	45,051.9	scf	1,275.90	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.211 g/hp-hr	0.283	g/kW-hr
CO		0.930 g/hp-hr	1.247	g/kW-hr
NOx	(Cell)	4.898 g/hp-hr	6.569	g/kW-hr
Particulate		0.116 g/hp-hr	0.156	g/kW-hr
CO2		563.7 g/hp-hr	755.97	g/kW-hr
BSFC		0.392 lb/hp-hr	0.238	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-H1
Date: 11/24/1997 Time: 01:46
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.30	in Hg	99.2 kPa
Engine Inlet Air			
Temperature:	76.0	°F	24.4 °C
Dew Point:	53.7	°F	12.1 °C
Abs. Humidity:	62.9	gr/lb	9.0 g/kg
Rel. Humidity:	46	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	64.7	gr/lb	9.2 g/kg
Rel. Humidity:	46	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		13.10	ppm	
HC Bckgrd	n/a		5.99	ppm	
CO Sample	12.6	2	12.90	ppm	
CO Bckgrd	0.3	2	0.32	ppm	
NOx Sample	n/a		52.82	ppm	(Dry)
NOx Bckgrd	0.6	2	0.60	ppm	
CO2 Sample	74.6	1	0.6572	%	
CO2 Bckgrd	7.8	1	0.0477	%	

Corrected Concentrations

HC	7.40	ppm
CO	12.25	ppm
NOx	51.16	ppm
CO2	0.6118	%

Mass Emissions

HC	5.401	grams	
CO	18.118	grams	
NOx	120.513	grams	
Particulate	2.792	grams	
CO2	14.221	kg	
Fuel	9.88 lb	4.48	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,167.2	61.38
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.86	0.08
Sample Rate:	1.28	0.04
20X20 Sample Rate:	40.85	1.16
47 mm Sample Rate:	20.14	0.57
Chemistry Sample Rate:	2.54	0.07
Total Flow Rate:	2,231.99	63.21

Particulate Data

Filter Number:	9003.0-34 (pair)
Weight Gain, mg:	1.604
Sample Multiplier:	1.741

Correction Factors

NOx Humidity CF:	0.969
Dry-to-Wet CF, Sample:	0.979
Dry-to-Wet CF, Bckgrd:	0.985
Dilution Factor:	20.63

Test Cycle Data

Sample Time:	1,207.40	sec		
Work:	26.80	hp-hr	19.98	kW-hr
Reference Work:	27.24	hp-hr	20.31	kW-hr
Total Volume (Vmix):	44,864.0	scf	1,270.58	scm

Brake-Specific Emission Results

BSHC (Cell)	0.202	g/hp-hr	0.270	g/kW-hr
CO	0.676	g/hp-hr	0.907	g/kW-hr
NOx (Cell)	4.497	g/hp-hr	6.030	g/kW-hr
Particulate	0.104	g/hp-hr	0.140	g/kW-hr
CO2	530.6	g/hp-hr	711.59	g/kW-hr
BSFC	0.369	lb/hp-hr	0.224	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-H2
Date: 11/24/1997 Time: 02:26
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.28	in Hg	99.2 kPa
Engine Inlet Air			
Temperature:	76.0	°F	24.4 °C
Dew Point:	55.1	°F	12.8 °C
Abs. Humidity:	66.3	gr/lb	9.5 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	64.7	gr/lb	9.2 g/kg
Rel. Humidity:	46	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		13.67	ppm	
HC Bckgrd	n/a		6.18	ppm	
CO Sample	12.5	2	12.80	ppm	
CO Bckgrd	0.4	2	0.42	ppm	
NOx Sample	n/a	-	53.07	ppm	(Dry)
NOx Bckgrd	0.5	2	0.50	ppm	
CO2 Sample	76.2	1	0.6785	%	
CO2 Bckgrd	8.8	1	0.0540	%	

Corrected Concentrations

HC	7.80	ppm
CO	12.05	ppm
NOx	51.49	ppm
CO2	0.6272	%

Mass Emissions

HC		5.693	grams	
CO		17.830	grams	
NOx		122.344	grams	
Particulate		2.726	grams	
CO2		14.580	kg	
Fuel	10.13	lb	4.59	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,166.3	61.35
Blower 2 Rate:	0.0	0.00
90 mm System:		-
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.91	0.08
Sample Rate:	1.33	0.04
20X20 Sample Rate:	41.19	1.17
47 mm Sample Rate:	20.62	0.58
Total Flow Rate:	2,229.48	63.14

Particulate Data

Filter Number:	9004.0-35 (pair)
Weight Gain, mg:	1.628
Sample Multiplier:	1.674

Correction Factors

NOx Humidity CF:	0.978
Dry-to-Wet CF, Sample:	0.979
Dry-to-Wet CF, Bckgrd:	0.985
Dilution Factor:	19.98

Test Cycle Data

Sample Time:	1,207.50	sec		
Work:	26.88	hp-hr	20.04	kW-hr
Reference Work:	27.24	hp-hr	20.31	kW-hr
Total Volume (Vmix):	44,868.4	scf	1,270.70	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.212 g/hp-hr	0.284	g/kW-hr
CO		0.663 g/hp-hr	0.890	g/kW-hr
NOx	(Cell)	4.551 g/hp-hr	6.104	g/kW-hr
Particulate		0.101 g/hp-hr	0.136	g/kW-hr
CO2		542.4 g/hp-hr	727.39	g/kW-hr
BSFC		0.377 lb/hp-hr	0.229	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Cold Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-C2
Date: 11/25/1997 Time: 09:13
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.33	in Hg	99.3 kPa
Engine Inlet Air			
Temperature:	77.0	°F	25.0 °C
Dew Point:	55.1	°F	12.8 °C
Abs. Humidity:	66.2	gr/lb	9.5 g/kg
Rel. Humidity:	47	%	
Dilution Air:			
Temperature:	76.0	°F	24.4 °C
Abs. Humidity	81.2	gr/lb	11.6 g/kg
Rel. Humidity:	59	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		13.09	ppm	
HC Bckgrd	n/a		5.83	ppm	
CO Sample	17.0	2	17.24	ppm	
CO Bckgrd	0.1	2	0.11	ppm	
NOx Sample	n/a		56.04	ppm	(Dry)
NOx Bckgrd	0.3	2	0.30	ppm	
CO2 Sample	77.8	1	0.7002	%	
CO2 Bckgrd	8.4	1	0.0515	%	

Corrected Concentrations

HC	7.56	ppm
CO	16.58	ppm
NOx	54.37	ppm
CO2	0.6514	%

Mass Emissions

HC		5.518	grams
CO		24.522	grams
NOx		129.129	grams
Particulate		3.072	grams
CO2		15.139	kg
Fuel	10.52 lb	4.77	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,170.0	61.46
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.05
Gas Meter 2:	2.88	0.08
Sample Rate:	1.29	0.04
20X20 Sample Rate:	36.48	1.03
47 mm Sample Rate:	21.48	0.61
Chemistry Sample Rate:	2.59	0.07
Total Flow Rate:	2,231.88	63.21

Particulate Data

Filter Number:	9014.0-39 (pair)
Weight Gain, mg:	1.781
Sample Multiplier:	1.725

Correction Factors

NOx Humidity CF:	0.978
Dry-to-Wet CF, Sample:	0.975
Dry-to-Wet CF, Bckgrd:	0.982
Dilution Factor:	19.36

Test Cycle Data

Sample Time:	1,207.40	sec		
Work:	26.59	hp-hr	19.83	kW-hr
Reference Work:	27.34	hp-hr	20.39	kW-hr
Total Volume (Vmix):	44,860.7	scf	1,270.48	scm

Brake-Specific Emission Results

BSHC (Cell)	0.208	g/hp-hr	0.278	g/kW-hr
CO	0.922	g/hp-hr	1.237	g/kW-hr
NOx (Cell)	4.856	g/hp-hr	6.512	g/kW-hr
Particulate	0.116	g/hp-hr	0.155	g/kW-hr
CO2	569.4	g/hp-hr	763.52	g/kW-hr
BSFC	0.396	lb/hp-hr	0.241	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-H3
Date: 11/25/1997 Time: 09:53
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.33	in Hg	99.3 kPa
Engine Inlet Air			
Temperature:	76.0	°F	24.4 °C
Dew Point:	55.1	°F	12.8 °C
Abs. Humidity:	66.2	gr/lb	9.5 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	79.5	gr/lb	11.4 g/kg
Rel. Humidity:	56	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		14.26	ppm	
HC Bckgrd	n/a		4.54	ppm	
CO Sample	13.3	2	13.59	ppm	
CO Bckgrd	0.3	2	0.32	ppm	
NOx Sample	n/a		51.99	ppm	(Dry)
NOx Bckgrd	0.3	2	0.30	ppm	
CO2 Sample	77.2	1	0.6920	%	
CO2 Bckgrd	8.9	1	0.0547	%	

Corrected Concentrations

HC	9.95	ppm
CO	12.87	ppm
NOx	50.44	ppm
CO2	0.6401	%

Mass Emissions

HC		7.296	grams	
CO		19.120	grams	
NOx		120.359	grams	
Particulate		2.868	grams	
CO2		14.946	kg	
Fuel	10.39	lb	4.71	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,170.0	61.46
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.04
Gas Meter 2:	2.91	0.08
Sample Rate:	1.32	0.04
20X20 Sample Rate:	42.78	1.21
47 mm Sample Rate:	25.13	0.71
Chemistry Sample Rate:	2.51	0.07
Total Flow Rate:	2,241.76	63.49

Particulate Data

Filter Number:	9015.0-40 (pair)
Weight Gain, mg:	1.686
Sample Multiplier:	1.701

Correction Factors

NOx Humidity CF:	0.978
Dry-to-Wet CF, Sample:	0.976
Dry-to-Wet CF, Bckgrd:	0.982
Dilution Factor:	19.59

Test Cycle Data

Sample Time:	1,207.60	sec		
Work:	26.87	hp-hr	20.04	kW-hr
Reference Work:	27.34	hp-hr	20.39	kW-hr
Total Volume (Vmix):	45,068.7	scf	1,276.37	scm

Brake-Specific Emission Results

BSHC (Cell)	0.272	g/hp-hr	0.364	g/kW-hr
CO	0.712	g/hp-hr	0.954	g/kW-hr
NOx (Cell)	4.479	g/hp-hr	6.007	g/kW-hr
Particulate	0.107	g/hp-hr	0.143	g/kW-hr
CO2	556.2	g/hp-hr	745.93	g/kW-hr
BSFC	0.387	lb/hp-hr	0.235	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-H4
Date: 11/25/1997 Time: 10:33
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.32	in Hg	99.3 kPa
Engine Inlet Air			
Temperature:	76.0	°F	24.4 °C
Dew Point:	55.4	°F	13.0 °C
Abs. Humidity:	66.9	gr/lb	9.6 g/kg
Rel. Humidity:	49	%	
Dilution Air:			
Temperature:	74.0	°F	23.3 °C
Abs. Humidity	89.8	gr/lb	12.8 g/kg
Rel. Humidity:	70	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		14.66	ppm	
HC Bckgrd	n/a		6.44	ppm	
CO Sample	13.5	2	13.79	ppm	
CO Bckgrd	0.3	2	0.32	ppm	
NOx Sample	n/a		51.88	ppm	(Dry)
NOx Bckgrd	0.3	2	0.30	ppm	
CO2 Sample	77.2	1	0.6920	%	
CO2 Bckgrd	9.4	1	0.0579	%	

Corrected Concentrations

HC	8.55	ppm
CO	13.00	ppm
NOx	50.22	ppm
CO2	0.6371	%

Mass Emissions

HC		6.268	grams
CO		19.320	grams
NOx		120.055	grams
Particulate		2.841	grams
CO2		14.876	kg
Fuel	10.34 lb	4.69	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,169.0	61.43
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.58	0.04
Gas Meter 2:	2.91	0.08
Sample Rate:	1.33	0.04
20X20 Sample Rate:	42.74	1.21
47 mm Sample Rate:	26.66	0.75
Total Flow Rate:	2,239.70	63.43

Particulate Data

Filter Number: 9016.0-41 (pair)
Weight Gain, mg: 1.684
Sample Multiplier: 1.687

Correction Factors

NOx Humidity CF:	0.979
Dry-to-Wet CF, Sample:	0.973
Dry-to-Wet CF, Bckgrd:	0.980
Dilution Factor:	19.59

Test Cycle Data

Sample Time:	1,207.40	sec		
Work:	26.96	hp-hr	20.10	kW-hr
Reference Work:	27.34	hp-hr	20.39	kW-hr
Total Volume (Vmix):	45,070.1	scf	1,276.41	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.232 g/hp-hr	0.312	g/kW-hr
CO		0.717 g/hp-hr	0.961	g/kW-hr
NOx	(Cell)	4.453 g/hp-hr	5.972	g/kW-hr
Particulate		0.105 g/hp-hr	0.141	g/kW-hr
CO2		551.8 g/hp-hr	739.94	g/kW-hr
BSFC		0.383 lb/hp-hr	0.233	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-H5
Date: 11/26/1997 Time: 09:32
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.21	in Hg	98.9 kPa
Engine Inlet Air			
Temperature:	76.0	°F	24.4 °C
Dew Point:	55.1	°F	12.8 °C
Abs. Humidity:	66.4	gr/lb	9.5 g/kg
Rel. Humidity:	48	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	74.8	gr/lb	10.7 g/kg
Rel. Humidity:	53	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		14.65	ppm	
HC Bckgrd	n/a		6.47	ppm	
CO Sample	14.6	2	14.88	ppm	
CO Bckgrd	0.7	2	0.74	ppm	
NOx Sample	n/a		52.89	ppm	(Dry)
NOx Bckgrd	0.4	2	0.40	ppm	
CO2 Sample	77.2	1	0.6920	%	
CO2 Bckgrd	9.3	1	0.0572	%	

Corrected Concentrations

HC	8.51	ppm
CO	13.74	ppm
NOx	51.28	ppm
CO2	0.6377	%

Mass Emissions

HC		6.207	grams
CO		20.313	grams
NOx		121.814	grams
Particulate		2.766	grams
CO2		14,814	kg
Fuel	10.30 lb	4.67	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,160.6	61.19
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.04
Gas Meter 2:	2.87	0.08
Sample Rate:	1.29	0.04
20X20 Sample Rate:	40.50	1.15
47 mm Sample Rate:	25.84	0.73
Chemistry Sample Rate:	2.57	0.07
Total Flow Rate:	2,230.76	63.18

Particulate Data

Filter Number:	9060.0-46 (pair)
Weight Gain, mg:	1.599
Sample Multiplier:	1.730

Correction Factors

NOx Humidity CF:	0.978
Dry-to-Wet CF, Sample:	0.977
Dry-to-Wet CF, Bckgrd:	0.983
Dilution Factor:	19.59

Test Cycle Data

Sample Time:	1,207.30	sec		
Work:	26.68	hp-hr	19.90	kW-hr
Reference Work:	27.26	hp-hr	20.33	kW-hr
Total Volume (Vmix):	44,835.0	scf	1,269.75	scm

Brake-Specific Emission Results

BSHC (Cell)	0.233	g/hp-hr	0.312	g/kW-hr
CO	0.761	g/hp-hr	1.021	g/kW-hr
NOx (Cell)	4.566	g/hp-hr	6.123	g/kW-hr
Particulate	0.104	g/hp-hr	0.139	g/kW-hr
CO2	555.2	g/hp-hr	744.58	g/kW-hr
BSFC	0.386	lb/hp-hr	0.235	kg/kW-hr

Analyzed: 12/02/1997 13:56

Southwest Research Institute - Department of Emissions Research
EPA Cold Transient Emission Test Results
Project No. 08-1039-000

Engine Model:	97 CUMMINS N-14	Test No.: 1-2D-C3	DIESEL 2D, EM-2494-F
Engine Desc.:	14.0 L (855 CID) I-6	Date: 11/26/1997 Time: 08:52	HCR: 1.796 FID Resp: 1.00
Engine Cycle:	Diesel	Program HDT: 4.01-R	H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine S/N:	11844196	Cell: 4 Bag Cart: 2	Engine Oil: CUMMINS BLUE
2-D			

Ambient/Test Cell Conditions

Barometer:	29.19	in Hg	98.8 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	53.7	°F	12.1 °C
Abs. Humidity:	63.1	gr/lb	9.0 g/kg
Rel. Humidity:	47	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	80.0	gr/lb	11.4 g/kg
Rel. Humidity:	56	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		13.39	ppm	
HC Bckgrd	n/a		5.38	ppm	
CO Sample	16.5	2	16.75	ppm	
CO Bckgrd	0.1	2	0.11	ppm	
NOx Sample	n/a		56.57	ppm	(Dry)
NOx Bckgrd	0.3	2	0.30	ppm	
CO2 Sample	77.5	1	0.6961	%	
CO2 Bckgrd	8.6	1	0.0528	%	

Corrected Concentrations

HC	8.29	ppm
CO	16.12	ppm
NOx	54.90	ppm
CO2	0.6460	%

Mass Emissions

HC		6.038	grams
CO		23.810	grams
NOx		129.201	grams
Particulate		2.995	grams
CO2		14.992	kg
Fuel	10.42 lb	4.73	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,159.3	61.15
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.04
Gas Meter 2:	2.85	0.08
Sample Rate:	1.26	0.04
20X20 Sample Rate:	40.57	1.15
47 mm Sample Rate:	25.68	0.73
Chemistry Sample Rate:	2.56	0.07
Total Flow Rate:	2,229.36	63.14

Particulate Data

Filter Number:	9059.0-45 (pair)
Weight Gain, mg:	1.694
Sample Multiplier:	1.768

Correction Factors

NOx Humidity CF:	0.970
Dry-to-Wet CF, Sample:	0.976
Dry-to-Wet CF, Bckgrd:	0.982
Dilution Factor:	19.47

Test Cycle Data

Sample Time:	1,206.90	sec		
Work:	26.43	hp-hr	19.71	kW-hr
Reference Work:	27.26	hp-hr	20.33	kW-hr
Total Volume (Vmix):	44,792.0	scf	1,268.54	scm

Brake-Specific Emission Results

BSHC	(Cell)	0.228 g/hp-hr	0.306	g/kW-hr
CO		0.901 g/hp-hr	1.208	g/kW-hr
NOx	(Cell)	4.888 g/hp-hr	6.556	g/kW-hr
Particulate		0.113 g/hp-hr	0.152	g/kW-hr
CO2		567.2 g/hp-hr	760.66	g/kW-hr
BSFC		0.394 lb/hp-hr	0.240	kg/kW-hr

Southwest Research Institute - Department of Emissions Research
EPA Hot Transient Emission Test Results
Project No. 08-1039-000

Engine Model: 97 CUMMINS N-14
Engine Desc.: 14.0 L (855 CID) I-6
Engine Cycle: Diesel
Engine S/N: 11844196
2-D

Test No.: 1-2D-H6
Date: 11/26/1997 Time: 10:12
Program HDT: 4.01-R
Cell: 4 Bag Cart: 2

DIESEL 2D, EM-2494-F
HCR: 1.796 FID Resp: 1.00
H= 0.131 C= 0.869 O= 0.000 X= 0.000
Engine Oil: CUMMINS BLUE

Ambient/Test Cell Conditions

Barometer:	29.21	in Hg	98.9 kPa
Engine Inlet Air			
Temperature:	75.0	°F	23.9 °C
Dew Point:	55.8	°F	13.2 °C
Abs. Humidity:	68.2	gr/lb	9.7 g/kg
Rel. Humidity:	51	%	
Dilution Air:			
Temperature:	77.0	°F	25.0 °C
Abs. Humidity	74.8	gr/lb	10.7 g/kg
Rel. Humidity:	53	%	

Measured Gaseous Data

	Meter	Range	Concentration		
HC Sample	n/a		15.35	ppm	
HC Bckgrd	n/a		4.37	ppm	
CO Sample	15.3	2	15.57	ppm	
CO Bckgrd	1.1	2	1.16	ppm	
NOx Sample	n/a		52.62	ppm	(Dry)
NOx Bckgrd	0.2	2	0.20	ppm	
CO2 Sample	77.7	1	0.6989	%	
CO2 Bckgrd	10.8	1	0.0669	%	

Corrected Concentrations

HC	11.21	ppm
CO	14.02	ppm
NOx	51.21	ppm
CO2	0.6354	%

Mass Emissions

HC		8.177	grams	
CO		20.731	grams	
NOx		122.231	grams	
Particulate		2.787	grams	
CO2		14.768	kg	
Fuel	10.27	lb	4.66	kg

Sample Flows

	scfm	scmm
Blower 1 Rate:	2,160.4	61.18
Blower 2 Rate:	0.0	0.00
90 mm System:		
Gas Meter 1:	1.59	0.05
Gas Meter 2:	2.88	0.08
Sample Rate:	1.29	0.04
20X20 Sample Rate:	41.19	1.17
47 mm Sample Rate:	25.68	0.73
Total Flow Rate:	2,228.52	63.11

Particulate Data

Filter Number:	9061.0-47 (pair)
Weight Gain, mg:	1.612
Sample Multiplier:	1.729

Correction Factors

NOx Humidity CF:	0.983
Dry-to-Wet CF, Sample:	0.977
Dry-to-Wet CF, Bckgrd:	0.983
Dilution Factor:	19.39

Test Cycle Data

Sample Time:	1,207.70	sec		
Work:	26.90	hp-hr	20.06	kW-hr
Reference Work:	27.26	hp-hr	20.33	kW-hr
Total Volume (Vmix):	44,856.5	scf	1,270.36	scm

Brake-Specific Emission Results

BSHC (Cell)	0.304	g/hp-hr	0.408	g/kW-hr
CO	0.771	g/hp-hr	1.033	g/kW-hr
NOx (Cell)	4.544	g/hp-hr	6.093	g/kW-hr
Particulate	0.104	g/hp-hr	0.139	g/kW-hr
CO2	549.0	g/hp-hr	736.21	g/kW-hr
BSFC	0.382	lb/hp-hr	0.232	kg/kW-hr

APPENDIX C

C_2 - C_{12} SPECIATION DATA

COMPOSITE SUMMARY

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0.00	0.0	0.93	0.0	0.75	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHANE	0.11	0.0	0.08	0.0	0.08	0.0	0.14	0.0	0.12	0.0	trace	0.0
ETHYLENE	8.36	61.1	8.28	60.4	8.26	60.2	10.44	76.1	10.88	79.3	10.46	76.3
PROPANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
PROPYLENE	1.50	14.1	1.48	13.9	1.43	13.5	3.47	32.6	3.57	33.6	3.51	33.0
ACETYLENE	1.50	0.7	1.49	0.7	1.48	0.7	1.90	0.9	1.95	1.0	1.92	1.0
PROPADIENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
BUTANE	0.00	0.0	0.00	0.0	0.02	0.0	0.21	0.2	trace	0.0	trace	0.0
TRANS-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.16	1.6	0.18	1.8	0.18	1.8
1-BUTENE	0.68	6.1	0.70	6.2	0.73	6.5	1.08	9.6	1.15	10.2	1.11	9.8
2-METHYLPROPENE (ISOBUTYLENE)	0.20	1.0	0.21	1.1	0.24	1.3	0.94	5.0	0.88	4.7	0.81	4.3
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
PROPYNE	0.09	0.4	0.00	0.0	0.02	0.1	0.20	0.8	0.19	0.8	0.20	0.8
1,3-BUTADIENE	1.02	11.1	1.13	12.3	1.22	13.2	1.35	14.7	1.33	14.5	1.29	14.0
2-METHYLPROPANE (ISOBUTANE)	0.00	0.0	0.00	0.0	0.02	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-BUTYNE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.14	1.4	0.12	1.2	0.13	1.3
3-METHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	trace	0.0	0.00	0.0	0.00	0.0	0.02	0.0	0.00	0.0	0.00	0.0
2-BUTYNE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.04	0.2	0.26	1.3	0.21	1.0
PENTANE	0.00	0.0	0.05	0.0	0.03	0.0	0.08	0.1	0.10	0.1	0.06	0.1
UNIDENTIFIED C5 OLEFINS	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	0.00	0.0	0.32	2.9	0.16	1.4	0.00	0.0	0.00	0.0	0.03	0.3
TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.2	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.3	0.22	1.9
2-METHYL-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TERT-BUTANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTADIENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.17	0.1
CYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.21	1.6	0.00	0.0
4-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.18	0.8	0.25	1.1	0.00	0.0
3-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	trace	0.0	0.00	0.0
MTBE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLPENTANE	0.00	0.0	0.26	0.4	0.02	0.0	0.25	0.4	0.19	0.3	0.08	0.1
4-METHYL-TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLPENTANE	0.00	0.0	0.00	0.0	0.04	0.1	0.25	0.4	0.18	0.3	0.17	0.3
2-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.02	0.1	0.50	2.2	0.51	2.3	0.60	2.7
1-HEXENE	0.00	0.0	0.00	0.0	0.02	0.1	0.50	2.2	0.51	2.3	0.60	2.7
HEXANE	0.37	0.4	0.36	0.4	0.43	0.4	0.00	0.0	0.03	0.0	0.00	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
UNIDENTIFIED C6 OLEFINS	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.24	1.6	0.00	0.0
TRANS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
DIISOPROPYL ETHER	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETBE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	0.24	0.3	0.30	0.4	0.07	0.1	0.00	0.0	0.00	0.0	0.10	0.1
METHYLCYCLOPENTANE, NOTE A	0.24	0.7	0.30	0.8	0.07	0.2	0.00	0.0	0.00	0.0	0.09	0.3
2,4-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.02	0.0
2,2,3-TRIMETHYLBUTANE	0.00	0.0	trace	0.0	0.03	0.0	0.00	0.0	0.00	0.0	trace	0.0
3,4-DIMETHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
BENZENE	0.93	0.4	0.85	0.4	0.88	0.4	0.82	0.3	1.12	0.5	0.85	0.4
3-METHYL-1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.0
CYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOHEXENE	0.00	0.0	0.00	0.0	0.24	1.4	0.00	0.0	0.00	0.0	trace	0.0
3-METHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.05	0.1
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.1
1-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	0.26	0.2	0.02	0.0	0.16	0.1	0.48	0.4	0.30	0.3	0.14	0.1
2-METHYL-1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-3-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
HEPTANE	0.22	0.2	0.38	0.3	0.41	0.3	0.00	0.0	0.03	0.0	0.07	0.1
CIS-3-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNIDENTIFIED C7	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.17	0.8	0.09	0.0
2-METHYL-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0.00	0.0	0.03	0.2	0.38	2.1	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.21	0.4	0.24	0.4	0.15	0.3
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.09	0.1
2,5-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.04	0.1	0.25	0.4	0.14	0.2
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	0.00	0.0	0.03	0.1	0.00	0.0	0.00	0.0	0.11	0.2	trace	0.0
2,3,3-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.01	0.0
TOLUENE	0.84	2.3	0.70	1.9	1.08	3.0	0.87	2.4	0.88	2.4	0.63	1.7
2,3-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.3	0.36	0.5
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.18	0.2
3,4-DIMETHYLHEXANE, NOTE B	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.17	0.2	0.24	0.3
2,2,5-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.19	0.2	0.03	0.0	0.03	0.0	0.30	0.3
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.0	0.19	0.2	0.00	0.0	0.00	0.0	0.17	0.2	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.37	0.7	0.50	1.0	0.57	1.1
1,1-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-4-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
OCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.29	0.2	0.32	0.2	0.37	0.2
UNIDENTIFIED C8	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.7
TRANS-2-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.0	0.00	0.0	0.00	0.0	0.60	0.7	0.66	0.8	0.53	0.6
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.0	0.00	0.0	0.00	0.0	0.22	0.2	0.25	0.3	0.25	0.3
3,3-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.69	1.9	0.79	2.1	0.88	2.4
2,3,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
m-& p-XYLENE	0.00	0.0	0.00	0.0	0.00	0.0	0.96	7.0	0.94	6.9	1.15	8.5
4-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-ETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.29	0.3	0.30	0.3	0.36	0.4
3-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.3	0.26	0.3	0.27	0.3
STYRENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
o-XYLENE	0.00	0.0	0.00	0.0	0.00	0.0	0.39	2.5	0.37	2.4	0.47	3.0
1-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.06	0.1	0.25	0.6	0.35	0.8
TRANS-3-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
CIS-3-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NONANE	0.00	0.0	0.00	0.0	0.00	0.0	0.69	0.4	0.75	0.4	0.80	0.4
TRANS-2-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0.00	0.0	0.00	0.0	0.00	0.0	0.15	0.3	0.03	0.1	0.30	0.7
2,2-DIMETHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.29	0.3	0.29	0.3	0.36	0.4
n-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.33	0.7	0.20	0.4	0.37	0.8
1-METHYL-3-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.23	1.7	0.52	3.7	0.51	3.7
1-METHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.30	2.2	0.38	2.8	0.34	2.4
1,3,5-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.42	4.2	0.43	4.3	0.42	4.3
1-METHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.42	3.0	0.40	2.9	0.40	2.9
1,2,4-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.07	0.6	0.76	6.7	0.58	5.1
TERT-BUTYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-DECENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
DECANE, NOTE F	0.00	0.0	0.00	0.0	0.00	0.0	0.52	0.2	0.50	0.2	0.47	0.2
ISOBUTYLBENZENE, NOTE F	0.00	0.0	0.00	0.0	0.00	0.0	0.49	0.9	0.47	0.9	0.44	0.8
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.1	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.28	2.5	0.33	2.9	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
INDAN	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.2	0.04	0.2	0.26	1.5
1,3-DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.36	2.3	0.22	1.4
1-METHYL-3-N-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.16	1.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.0	0.00	0.0	0.00	0.0	0.15	1.0	0.49	3.1	0.26	1.7
1,2 DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.25	1.6	0.26	1.7	0.22	1.4
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.3	0.44	4.0	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNDECANE	0.00	0.0	0.00	0.0	0.00	0.0	1.72	0.7	2.59	1.1	1.93	0.8
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	2.19	19.8	0.80	7.3	0.24	2.2
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.12	1.1	0.55	5.0	0.30	2.7
TERT-1-BUT-2-METHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.55	3.2	0.39	2.3	0.42	2.4
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
N-PENT-BENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.59	1.0	0.77	1.3	0.74	1.3
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.24	1.8	0.39	2.9	0.24	1.8
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NAPHTHALENE	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.3	0.25	0.3	0.37	0.4
DODECANE	0.00	0.0	0.00	0.0	0.00	0.0	1.47	0.6	1.67	0.6	1.74	0.7
1,3,5-TRIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
HEXYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	0.00	0.0	0.00	0.0	0.00	0.0	3.71	14.2	5.33	20.3	3.89	14.8
FORMALDEHYDE	9.49	67.9	8.99	64.3	8.72	62.4	12.86	92.0	13.60	97.2	13.62	97.4
ACETALDEHYDE	3.07	17.0	3.05	16.8	3.04	16.8	4.78	26.4	4.61	25.5	4.66	26.8
ACROLEIN	2.16	14.8	2.76	18.7	2.54	17.2	1.65	11.1	1.15	7.8	1.52	10.3
ACETONE	0.69	0.4	0.52	0.3	0.51	0.3	1.40	0.8	1.41	0.8	1.38	0.8
PROPIONALDEHYDE	1.79	11.7	1.40	9.2	1.04	6.8	1.23	8.0	2.53	16.6	2.35	15.3
CROTONALDEHYDE	0.96	5.2	0.64	3.5	0.81	4.4	1.67	9.1	2.29	12.4	1.87	10.1

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
ISOBUTYRALDEHYDE, NOTE H	0.32	1.7	0.38	2.0	0.29	1.5	0.41	2.2	0.52	2.7	0.56	3.0
METHYL ETHYL KETONE, NOTE H	0.32	0.4	0.38	0.4	0.29	0.3	0.41	0.5	0.52	0.6	0.56	0.7
BENZALDEHYDE	0.04	-0.0	0.00	0.0	0.00	0.0	0.56	-0.3	0.47	-0.3	0.82	-0.5
ISOVALERALDEHYDE	0.54	2.4	0.82	3.6	0.63	2.6	0.60	2.7	0.24	1.1	0.29	1.3
VALERALDEHYDE	0.27	1.2	0.33	1.5	0.16	0.7	0.36	1.6	0.36	1.6	0.45	2.0
O-TOLUALDEHYDE	0.37	-0.2	0.49	-0.3	0.31	-0.2	0.34	-0.2	0.32	-0.2	0.40	-0.2
M/P-TOLUALDEHYDE	1.30	-0.7	1.41	-0.8	1.62	-0.9	2.07	-1.1	1.87	-1.0	1.67	-0.9
HEXANALDEHYDE	1.08	4.1	0.90	3.4	0.90	3.4	0.46	1.7	0.36	1.3	0.35	1.3
DIMETHYLBENZALDEHYDE	0.00	-0.0	0.00	0.0	0.00	0.0	0.26	-0.1	0.47	-0.3	0.23	-0.1
SUMMED SPECIATED VALUES	39	225	40	225	39	221	73	384	82	424	77	396

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

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COLD START SUMMARY

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0.00	0.0	0.00	0.0	0.60	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHANE	0.15	0.0	0.19	0.0	0.23	0.1	0.06	0.0	0.00	0.0	0.04	0.0
ETHYLENE	9.79	71.4	9.20	67.0	9.37	68.3	11.64	84.8	11.62	84.7	11.54	84.2
PROPANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
PROPYLENE	1.60	15.1	1.42	13.4	1.57	14.8	3.69	34.7	3.63	34.1	3.62	34.0
ACETYLENE	1.72	0.9	1.68	0.8	1.74	0.9	2.24	1.1	2.17	1.1	2.19	1.1
PROPADIENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
BUTANE	0.00	0.0	0.00	0.0	0.17	0.2	0.15	0.2	0.00	0.0	0.06	0.1
TRANS-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.19	1.9	0.18	1.7	0.17	1.7
1-BUTENE	0.78	6.9	0.71	6.3	0.72	6.4	1.12	10.0	1.10	9.8	1.10	9.8
2-METHYLPROPENE (ISOBUTYLENE)	0.26	1.4	0.23	1.2	0.22	1.2	1.04	5.5	0.93	4.9	0.96	5.1
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
PROPYNE	0.00	0.0	0.00	0.0	0.11	0.4	0.22	0.9	0.22	0.9	0.21	0.9
1,3-BUTADIENE	1.08	11.8	1.14	12.4	1.26	13.7	1.37	15.0	1.31	14.3	1.33	14.5
2-METHYLPROPANE (ISOBUTANE)	0.00	0.0	0.00	0.0	0.12	0.1	0.00	0.0	0.00	0.0	0.00	0.0
1-BUTYNE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.17	1.7	0.12	1.2	0.13	1.3
3-METHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	0.04	0.1	0.00	0.0	0.02	0.0	0.13	0.2	0.00	0.0	0.00	0.0
2-BUTYNE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.26	1.3	0.23	1.1	0.26	1.3
PENTANE	0.00	0.0	0.33	0.3	0.23	0.2	0.12	0.1	trace	0.0	0.03	0.0
UNIDENTIFIED C5 OLEFINS	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	0.00	0.0	0.14	1.3	0.24	2.2	0.00	0.0	0.00	0.0	0.20	1.8
TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.18	1.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.24	2.1	0.26	2.3
2-METHYL-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TERT-BUTANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTADIENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
MTBE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLPENTANE	0.00	0.0	0.31	0.5	0.11	0.2	0.28	0.4	0.04	0.1	0.00	0.0
4-METHYL-TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLPENTANE	0.00	0.0	0.00	0.0	0.28	0.4	0.42	0.6	0.09	0.1	0.04	0.1
2-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.12	0.5	0.52	2.3	0.56	2.5	0.54	2.4
1-HEXENE	0.00	0.0	0.00	0.0	0.12	0.5	0.52	2.3	0.56	2.5	0.54	2.4
HEXANE	0.35	0.3	0.26	0.3	0.46	0.4	0.00	0.0	0.00	0.0	0.02	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
UNIDENTIFIED C6 OLEFINS	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	1.4	0.00	0.0
TRANS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETBE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	0.21	0.3	0.12	0.2	0.04	0.1	0.00	0.0	0.00	0.0	0.00	0.0
METHYLCYCLOPENTANE, NOTE A	0.21	0.6	0.12	0.3	0.04	0.1	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.13	0.2
2,2,3-TRIMETHYLBUTANE	0.00	0.0	0.04	0.0	0.10	0.1	0.00	0.0	0.00	0.0	trace	0.0
3,4-DIMETHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
BENZENE	0.91	0.4	0.97	0.4	0.86	0.4	1.24	0.5	1.04	0.4	1.35	0.6
3-METHYL-1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.2
CYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.02	0.0
1,1-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOHEXENE	0.00	0.0	0.00	0.0	0.26	1.5	0.00	0.0	0.00	0.0	trace	0.1
3-METHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.5
1-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	0.34	0.3	0.16	0.1	0.08	0.1	0.50	0.5	0.41	0.4	0.20	0.2
2-METHYL-1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-3-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
HEPTANE	0.23	0.2	0.30	0.2	0.21	0.2	0.00	0.0	0.20	0.2	0.00	0.0
CIS-3-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNIDENTIFIED C7	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0.00	0.0	0.24	1.3	0.27	1.5	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.24	0.4	0.26	0.5	0.11	0.2
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.24	0.3
2,5-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.28	0.4	0.00	0.0	0.04	0.1
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	0.00	0.0	0.22	0.4	0.00	0.0	0.00	0.0	0.25	0.4	0.06	0.1
2,3,3-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.03	0.0	0.05	0.1
TOLUENE	2.37	6.5	2.32	6.3	6.52	17.8	1.28	3.5	1.90	5.2	1.89	5.2
2,3-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.17	0.2	0.21	0.3
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4-DIMETHYLHEXANE, NOTE B	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,5-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.2	0.21	0.2	0.25	0.2
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.34	0.7	0.47	0.9	0.49	0.9
1,1-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-4-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
OCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.27	0.2	0.27	0.2	0.35	0.2
UNIDENTIFIED C8	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.0	0.00	0.0	0.00	0.0	0.52	0.6	0.62	0.7	0.63	0.7
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.2	0.24	0.3	0.24	0.3
3,3-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.81	2.2	0.76	2.1	0.81	2.2
2,3,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
m-& p-XYLENE	0.00	0.0	0.00	0.0	0.00	0.0	1.69	12.5	0.79	5.8	1.07	7.9
4-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-ETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.39	0.4	0.00	0.0	0.28	0.3
3-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.21	0.2	0.19	0.2	0.19	0.2
STYRENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
o-XYLENE	0.00	0.0	0.00	0.0	0.00	0.0	0.57	3.7	0.38	2.4	0.59	3.8
1-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.43	1.0	0.39	0.9	0.46	1.0
TRANS-3-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

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COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
CIS-3-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NONANE	0.00	0.0	0.00	0.0	0.00	0.0	0.72	0.4	0.70	0.4	0.47	0.3
TRANS-2-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.24	0.5	0.24	0.5
2,2-DIMETHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.29	0.3	0.29	0.3	0.41	0.4
n-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.34	0.7	0.30	0.6	0.23	0.5
1-METHYL-3-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.25	1.8	0.55	3.9	0.41	2.9
1-METHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.47	3.4	0.36	2.6	0.26	1.9
1,3,5-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.51	5.2	0.41	4.1	0.27	2.8
1-METHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.21	1.5	0.37	2.6	0.30	2.2
1,2,4-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.47	4.2	0.81	7.1	0.12	1.1
TERT-BUTYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-DECENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
DECANE, NOTE F	0.00	0.0	0.00	0.0	0.00	0.0	0.54	0.3	0.59	0.3	0.14	0.1
ISOBUTYLBENZENE, NOTE F	0.00	0.0	0.00	0.0	0.00	0.0	0.51	0.9	0.56	1.0	0.14	0.3
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.4	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.32	2.8	0.44	3.9	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
INDAN	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.19	1.1	0.27	1.6	0.23	1.4
1,3-DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.27	1.8	0.00	0.0
1-METHYL-3-N-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2 DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	1.3	0.25	1.6
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.24	2.2	0.38	3.4	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNDECANE	0.00	0.0	0.00	0.0	0.00	0.0	1.87	0.8	2.23	0.9	1.50	0.6
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	1.42	12.9	0.42	3.8	0.50	4.5
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.83	7.5	0.67	6.1	0.00	0.0
TERT-1-BUT-2-METHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.53	3.1	0.34	2.0	0.21	1.2
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
N-PENT-BENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.61	1.0	0.63	1.1	0.55	0.9
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.25	1.8	0.38	2.9	0.28	2.1
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NAPHTHALENE	0.00	0.0	0.00	0.0	0.00	0.0	0.22	0.3	0.21	0.2	0.43	0.5
DODECANE	0.00	0.0	0.00	0.0	0.00	0.0	1.32	0.5	1.30	0.5	1.81	0.7
1,3,5-TRIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
HEXYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	0.00	0.0	0.00	0.0	0.00	0.0	4.99	19.0	4.14	15.8	2.63	10.8
FORMALDEHYDE	11.46	82.1	9.74	69.6	10.15	72.6	14.34	102.6	13.47	96.3	14.38	102.8
ACETALDEHYDE	3.49	19.3	3.53	19.5	3.67	20.3	6.01	33.2	4.77	26.3	5.19	28.6
ACROLEIN	2.38	16.1	2.74	18.6	2.90	19.6	1.83	12.4	1.24	8.4	1.56	10.6
ACETONE	0.98	0.5	0.99	0.6	1.07	0.6	2.08	1.2	1.53	0.9	2.13	1.2
PROPIONALDEHYDE	1.88	12.3	1.28	8.4	1.12	7.3	1.55	10.2	2.77	18.1	1.96	12.8
CROTONALDEHYDE	1.04	5.6	0.72	3.9	1.25	6.8	1.42	7.7	2.30	12.5	1.99	10.8

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
ISOBUTYRALDEHYDE, NOTE H	0.37	2.0	0.46	2.4	0.32	1.7	0.50	2.6	0.43	2.3	0.44	2.3
METHYL ETHYL KETONE, NOTE H	0.37	0.4	0.46	0.5	0.32	0.4	0.50	0.6	0.43	0.5	0.44	0.5
BENZALDEHYDE	0.25	-0.1	0.00	0.0	0.00	0.0	0.68	-0.4	0.46	-0.3	0.66	-0.4
ISOVALERALDEHYDE	0.62	2.7	0.62	2.7	0.74	3.3	0.52	2.3	0.26	1.1	0.31	1.4
VALERALDEHYDE	0.25	1.1	0.31	1.4	0.16	0.7	0.40	1.8	0.47	2.1	0.70	3.1
O-TOLUALDEHYDE	0.42	-0.2	0.70	-0.4	0.30	-0.2	0.17	-0.1	0.29	-0.2	0.29	-0.2
M/P-TOLUALDEHYDE	1.45	-0.8	1.35	-0.7	1.70	-0.9	2.81	-1.5	2.17	-1.2	2.03	-1.1
HEXANALDEHYDE	1.01	3.8	0.87	3.3	0.98	3.7	0.52	2.0	0.38	1.4	0.37	1.4
DIMETHYLBENZALDEHYDE	0.00	0.0	0.00	0.0	0.00	0.0	0.25	-0.1	0.42	-0.2	0.26	-0.1
SUMMED SPECIATED VALUES	46	261	44	243	51	268	84	436	81	422	78	399

A - 2,2-Dimethylpentane and methylcyclopentane co-elute GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately
H - Isobutyraldehyde and methyl ethyl ketone co-elute LC peak area split equally between the two compounds.

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HOT START SUMMARY

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0.00	0.0	1.08	0.0	0.78	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHANE	0.11	0.0	0.04	0.0	0.06	0.0	0.15	0.0	0.13	0.0	0.00	0.0
ETHYLENE	8.15	59.4	8.13	59.3	8.08	58.9	10.24	74.6	10.76	78.4	10.28	75.0
PROPANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
PROPYLENE	1.49	14.0	1.49	14.0	1.41	13.3	3.44	32.3	3.56	33.5	3.50	32.9
ACETYLENE	1.46	0.7	1.46	0.7	1.43	0.7	1.84	0.9	1.91	1.0	1.87	0.9
PROPADIENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
BUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.22	0.2	0.02	0.0	0.00	0.0
TRANS-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.16	1.6	0.18	1.8	0.18	1.8
1-BUTENE	0.67	6.0	0.70	6.2	0.73	6.5	1.07	9.5	1.15	10.3	1.11	9.9
2-METHYLPROPENE (ISOBUTYLENE)	0.19	1.0	0.20	1.1	0.25	1.3	0.93	4.9	0.88	4.6	0.79	4.2
2,2-DIMETHYLPROPANE (NEOPENTANE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
PROPYNE	0.10	0.4	0.00	0.0	0.00	0.0	0.20	0.8	0.19	0.8	0.20	0.8
1,3-BUTADIENE	1.01	11.0	1.13	12.3	1.21	13.1	1.35	14.7	1.34	14.6	1.28	14.0
2-METHYLPROPANE (ISOBUTANE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-BUTYNE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.14	1.4	0.12	1.2	0.13	1.3
3-METHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-BUTYNE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.26	1.3	0.21	1.0
PENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.08	0.1	0.11	0.1	0.07	0.1
UNIDENTIFIED C5 OLEFINS	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	0.00	0.0	0.36	3.2	0.14	1.3	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.21	1.9
2-METHYL-2-BUTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TERT-BUTANOL	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTADIENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.2
CYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.25	1.9	0.00	0.0
4-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.21	0.9	0.29	1.3	0.00	0.0
3-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	trace	0.0	0.00	0.0
MTBE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLPENTANE	0.00	0.0	0.26	0.4	0.00	0.0	0.24	0.4	0.21	0.3	0.09	0.1
4-METHYL-TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.22	0.3	0.19	0.3	0.19	0.3
2-METHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.50	2.2	0.50	2.2	0.61	2.7
1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.50	2.2	0.50	2.2	0.61	2.7
HEXANE	0.37	0.4	0.40	0.4	0.43	0.4	0.00	0.0	0.03	0.0	0.00	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
UNIDENTIFIED C6 OLEFINS	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.25	1.6	0.00	0.0
TRANS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETBE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	0.25	0.3	0.33	0.5	0.08	0.1	0.00	0.0	0.00	0.0	0.11	0.2
METHYLCYCLOPENTANE, NOTE A	0.24	0.7	0.33	0.9	0.08	0.2	0.00	0.0	0.00	0.0	0.11	0.3
2,4-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,3-TRIMETHYLBUTANE	0.00	0.0	0.00	0.0	0.02	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4-DIMETHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
BENZENE	0.94	0.4	0.83	0.3	0.88	0.4	0.75	0.3	1.13	0.5	0.76	0.3
3-METHYL-1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CYCLOHEXENE	0.00	0.0	0.00	0.0	0.24	1.4	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.06	0.1
TRANS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	0.25	0.2	0.00	0.0	0.17	0.2	0.48	0.4	0.28	0.3	0.14	0.1
2-METHYL-1-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-3-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
HEPTANE	0.21	0.2	0.39	0.3	0.44	0.4	0.00	0.0	0.00	0.0	0.08	0.1
CIS-3-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNIDENTIFIED C7	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.9	0.00	0.0
2-METHYL-2-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-2-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0.00	0.0	0.00	0.0	0.40	2.2	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-HEPTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.21	0.4	0.24	0.4	0.15	0.3
CIS-1,2-DIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.06	0.1
2,5-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.29	0.4	0.16	0.2
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.08	0.1	0.00	0.0
2,3,3-TRIMETHYLPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.04	0.0
TOLUENE	0.59	1.6	0.44	1.2	0.18	0.5	0.80	2.2	0.70	1.9	0.42	1.2
2,3-DIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.24	0.3	0.39	0.5
1,1,2-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.21	0.2
3,4-DIMETHYLHEXANE, NOTE B	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-METHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3-ETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.20	0.2	0.26	0.3
2,2,5-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.23	0.2	0.00	0.0	0.00	0.0	0.31	0.3
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.0	0.22	0.3	0.00	0.0	0.00	0.0	0.19	0.2	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.37	0.7	0.51	1.0	0.58	1.1
1,1-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-4-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
OCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.29	0.2	0.33	0.2	0.38	0.2
UNIDENTIFIED C8	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.8
TRANS-2-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-2-OCTENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	0.00	0.0	0.00	0.0	0.00	0.0	0.62	0.7	0.67	0.8	0.51	0.6
1,1,3-TRIMETHYLCYCLOHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	0.00	0.0	0.00	0.0	0.00	0.0	0.22	0.3	0.25	0.3	0.25	0.3
3,3-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.67	1.8	0.80	2.1	0.89	2.4
2,3,4-TRIMETHYLHEXANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
m-& p-XYLENE	0.00	0.0	0.00	0.0	0.00	0.0	0.83	6.1	0.97	7.1	1.16	8.6
4-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
4-ETHYLHEPTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.27	0.3	0.35	0.4	0.37	0.4
3-METHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.3	0.27	0.3	0.28	0.3
STYRENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
o-XYLENE	0.00	0.0	0.00	0.0	0.00	0.0	0.36	2.3	0.37	2.4	0.44	2.9
1-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.5	0.33	0.7
TRANS-3-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

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COMPOUND	1-SME-1		1-SME-2		1-SME-3		1-2D-1		1-2D-2		1-2D-3	
	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
CIS-3-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NONANE	0.00	0.0	0.00	0.0	0.00	0.0	0.69	0.4	0.76	0.4	0.86	0.5
TRANS-2-NONENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0.00	0.0	0.00	0.0	0.00	0.0	0.17	0.4	0.00	0.0	0.31	0.7
2,2-DIMETHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	0.00	0.0	0.00	0.0	0.00	0.0	0.30	0.3	0.29	0.3	0.35	0.4
n-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.33	0.7	0.18	0.4	0.39	0.8
1-METHYL-3-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.23	1.7	0.51	3.7	0.53	3.8
1-METHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.27	2.0	0.39	2.8	0.35	2.5
1,3,5-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.40	4.1	0.43	4.3	0.45	4.5
1-METHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.46	3.3	0.41	2.9	0.41	3.0
1,2,4-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.76	6.7	0.66	5.8
TERT-BUTYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-DECENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
DECANE, NOTE F	0.00	0.0	0.00	0.0	0.00	0.0	0.52	0.2	0.48	0.2	0.53	0.2
ISOBUTYLBENZENE, NOTE F	0.00	0.0	0.00	0.0	0.00	0.0	0.49	0.9	0.45	0.8	0.50	0.9
1,3,-DIMETHYL-5-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.27	2.4	0.31	2.8	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
INDAN	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.26	1.5
1,3-DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.37	2.4	0.26	1.7
1-METHYL-3-N-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.19	1.2	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0.00	0.0	0.00	0.0	0.00	0.0	0.18	1.1	0.57	3.7	0.30	1.9
1,2 DIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.29	1.9	0.27	1.8	0.21	1.4
1,4-DIMETHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.45	4.1	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNDECANE	0.00	0.0	0.00	0.0	0.00	0.0	1.70	0.7	2.65	1.1	2.00	0.8
1,2-DIMETHYL-3-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	2.31	21.0	0.87	7.9	0.20	1.8
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.53	4.8	0.34	3.1
TERT-1-BUT-2-METHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.56	3.2	0.40	2.3	0.45	2.6
1,2,3,4-TETRAMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
N-PENT-BENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.56	1.0	0.79	1.3	0.77	1.3
TERT-1-BUT-3,5-DIMETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.24	1.8	0.39	2.9	0.23	1.8
TERT-1-BUTYL-4-ETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
NAPHTHALENE	0.00	0.0	0.00	0.0	0.00	0.0	0.23	0.3	0.26	0.3	0.37	0.4
DODECANE	0.00	0.0	0.00	0.0	0.00	0.0	1.50	0.6	1.74	0.7	1.72	0.7
1,3,5-TRIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
HEXYLBENZENE	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	0.00	0.0	0.00	0.0	0.00	0.0	3.50	13.3	5.53	21.1	4.06	15.5
FORMALDEHYDE	9.16	65.5	8.86	63.4	8.49	60.7	12.62	90.2	13.62	97.4	13.50	96.5
ACETALDEHYDE	3.01	16.6	2.97	16.4	2.93	16.2	4.57	25.2	4.59	25.3	4.80	26.5
ACROLEIN	2.13	14.4	2.76	18.7	2.48	16.8	1.62	10.9	1.13	7.7	1.51	10.2
ACETONE	0.64	0.4	0.45	0.2	0.41	0.2	1.29	0.7	1.39	0.8	1.26	0.7
PROPIONALDEHYDE	1.77	11.6	1.42	9.3	1.02	6.7	1.17	7.7	2.49	16.3	2.41	15.7
CROTONALDEHYDE	0.94	5.1	0.63	3.4	0.74	4.0	1.71	9.3	2.29	12.4	1.85	10.0

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COMPOUND	1-SME-1 MG/BHP-HR	1-SME-1 OZONE, MG/BHP-HR	1-SME-2 MG/BHP-HR	1-SME-2 OZONE, MG/BHP-HR	1-SME-3 MG/BHP-HR	1-SME-3 OZONE, MG/BHP-HR	1-2D-1 MG/BHP-HR	1-2D-1 OZONE, MG/BHP-HR	1-2D-2 MG/BHP-HR	1-2D-2 OZONE, MG/BHP-HR	1-2D-3 MG/BHP-HR	1-2D-3 OZONE, MG/BHP-HR
ISOBUTYRALDEHYDE, NOTE H	0.31	1.6	0.36	1.9	0.28	1.5	0.40	2.1	0.53	2.8	0.58	3.1
METHYL ETHYL KETONE, NOTE H	0.31	0.4	0.38	0.4	0.28	0.3	0.40	0.5	0.53	0.6	0.58	0.7
BENZALDEHYDE	0.00	0.0	0.00	0.0	0.00	0.0	0.54	-0.3	0.48	-0.3	0.84	-0.5
ISOVALERALDEHYDE	0.53	2.3	0.85	3.8	0.61	2.7	0.62	2.7	0.24	1.1	0.28	1.3
VALERALDEHYDE	0.28	1.2	0.34	1.5	0.16	0.7	0.36	1.6	0.34	1.5	0.40	1.8
O-TOLUALDEHYDE	0.36	-0.2	0.46	-0.3	0.31	-0.2	0.37	-0.2	0.32	-0.2	0.41	-0.2
M/P-TOLUALDEHYDE	1.28	-0.7	1.42	-0.8	1.60	-0.9	1.95	-1.1	1.82	-1.0	1.60	-0.9
HEXANALDEHYDE	1.09	4.1	0.90	3.4	0.89	3.4	0.44	1.7	0.35	1.3	0.35	1.3
DIMETHYLBENZALDEHYDE	0.00	-0.0	0.00	0.0	0.00	0.0	0.26	-0.1	0.47	-0.3	0.22	-0.1
SUMMED SPECIATED VALUES	38	219	40	222	37	213	71	375	82	424	77	396

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

TEST NUMBER: 1-SME-1
ENGINE: 1997 CUMMINS N-14
TEST DATE: 11/17/97
TEST FUEL: EM-2481-F

	COLD					HOT					COMPOSITE	
COMPOUND	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0	0.00			0.0	0	0.00			0.0	0.00	0.0
ETHANE	3	0.15	0.32	0.001	0.0	3	0.11	0.28	0.001	0.0	0.11	0.0
ETHYLENE	234	9.79	21.26	1.550	71.4	197	8.15	21.53	1.570	59.4	8.38	61.1
PROPANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYLENE	38	1.60	3.48	0.327	15.1	36	1.49	3.93	0.369	14.0	1.50	14.1
ACETYLENE	41	1.72	3.75	0.019	0.9	35	1.46	3.86	0.019	0.7	1.50	0.7
PROPADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTENE	19	0.78	1.69	0.150	6.9	16	0.67	1.77	0.158	6.0	0.68	6.1
2-METHYLPROPENE (ISOBUTYLENE)	6	0.26	0.56	0.030	1.4	4	0.19	0.49	0.026	1.0	0.20	1.0
2,2-DIMETHYLPROPANE (NEOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYNE	0	0.00	0.00	0.000	0.0	2	0.10	0.27	0.011	0.4	0.09	0.4
1,3-BUTADIENE	26	1.08	2.34	0.255	11.8	24	1.01	2.68	0.292	11.0	1.02	11.1
2-METHYLPROPANE (ISOBUTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	1	0.04	0.09	0.001	0.1	0	0.00	0.00	0.000	0.0	trace	0.0
2-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C5 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
MTBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXANE	8	0.35	0.76	0.007	0.3	9	0.37	0.99	0.010	0.4	0.37	0.4

UNIDENTIFIED C6 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	5	0.21	0.46	0.006	0.3	6	0.25	0.65	0.009	0.3	0.24	0.3
METHYLCYCLOPENTANE, NOTE A	5	0.21	0.45	0.013	0.6	6	0.24	0.64	0.018	0.7	0.24	0.7
2,4-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BENZENE	22	0.91	1.97	0.008	0.4	23	0.94	2.48	0.010	0.4	0.93	0.4
3-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	8	0.34	0.74	0.007	0.3	6	0.25	0.67	0.006	0.2	0.26	0.2
2-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEPTANE	6	0.23	0.50	0.004	0.2	5	0.21	0.56	0.005	0.2	0.22	0.2
CIS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C7	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TOLUENE	57	2.37	5.16	0.141	6.5	14	0.59	1.55	0.042	1.6	0.84	2.3
2,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,2-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEXANE, NOTE B	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-4-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
OCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C8	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
m-& p-XYLENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-ETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
STYRENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
o-XYLENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

CIS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NONANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
n-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,5-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-DECENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DECANE, NOTE F	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOBUTYLBENZENE, NOTE F	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,-DIMETHYL-5-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
INDAN	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2 DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNDECANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUT-2-METHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,4-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
N-PENT-BENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUT-3,5-DIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUTYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NAPHTHALENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DODECANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,5-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
FORMALDEHYDE	274	11.48	24.93	1.783	82.1	221	9.16	24.22	1.732	65.5	9.49	67.9
ACETALDEHYDE	83	3.49	7.58	0.418	19.3	73	3.01	7.95	0.439	16.6	3.07	17.0
ACROLEIN	57	2.38	5.16	0.349	16.1	51	2.13	5.62	0.381	14.4	2.16	14.6
ACETONE	23	0.98	2.13	0.012	0.5	15	0.64	1.69	0.009	0.4	0.69	0.4
PROPIONALDEHYDE	45	1.88	4.09	0.267	12.3	43	1.77	4.68	0.306	11.6	1.79	11.7
CROTONALDEHYDE	25	1.04	2.26	0.123	5.6	23	0.94	2.49	0.135	5.1	0.96	5.2

ISOBUTYRALDEHYDE, NOTE H	9	0.37	0.81	0.043	2.0	8	0.31	0.82	0.043	1.6	0.32	1.7
METHYL ETHYL KETONE, NOTE H	9	0.37	0.81	0.010	0.4	8	0.31	0.82	0.010	0.4	0.32	0.4
BENZALDEHYDE	6	0.25	0.54	-0.003	-0.1	0	0.00	0.00	0.000	0.0	0.04	-0.0
ISOVALERALDEHYDE	15	0.62	1.35	0.060	2.7	13	0.53	1.39	0.061	2.3	0.54	2.4
VALERALDEHYDE	6	0.25	0.55	0.024	1.1	7	0.28	0.73	0.032	1.2	0.27	1.2
O-TOLUALDEHYDE	10	0.42	0.92	-0.005	-0.2	9	0.36	0.96	-0.005	-0.2	0.37	-0.2
M/P-TOLUALDEHYDE	35	1.45	3.14	-0.017	-0.8	31	1.28	3.37	-0.019	-0.7	1.30	-0.7
HEXANALDEHYDE	24	1.01	2.19	0.083	3.8	26	1.09	2.88	0.109	4.1	1.08	4.1
DIMETHYLBENZALDEHYDE	0	0.00	0.00	0.000	0.0	0	0.00	0.01	-0.000	-0.0	0.00	-0.0
SUMMED SPECIATED VALUES	1101	46	100	6	261	913	38	100	6	219	39	225

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

BAG CART VALUES												
HC	755	32				118	5				9	
CO	13412	561				9549	396				419	
CO2	13906000	581598				13312000	551678				555953	
NOX	127996	5353				122908	5094				5131	

TEST NUMBER: 1-SME-2
ENGINE: 1997 CUMMINS N-14
TEST DATE: 11/18/97
TEST FUEL: EM-2481-F

	COLD					HOT					COMPOSITE	
COMPOUND	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0	0.00			0.0	26	1.08			0.0	0.93	0.0
ETHANE	5	0.19	0.43	0.001	0.0	1	0.04	0.11	0.000	0.0	0.06	0.0
ETHYLENE	219	9.20	20.96	1.528	67.0	196	8.13	21.13	1.540	59.3	8.28	60.4
PROPANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYLENE	34	1.42	3.24	0.305	13.4	36	1.49	3.87	0.364	14.0	1.48	13.9
ACETYLENE	40	1.68	3.83	0.019	0.8	35	1.46	3.80	0.019	0.7	1.49	0.7
PROPADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTENE	17	0.71	1.62	0.144	6.3	17	0.70	1.81	0.162	6.2	0.70	6.2
2-METHYLPROPENE (ISOBUTYLENE)	5	0.23	0.53	0.028	1.2	5	0.20	0.52	0.028	1.1	0.21	1.1
2,2-DIMETHYLPROPANE (NEOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-BUTADIENE	27	1.14	2.60	0.283	12.4	27	1.13	2.93	0.319	12.3	1.13	12.3
2-METHYLPROPANE (ISOBUTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PENTANE	8	0.33	0.74	0.008	0.3	0	0.00	0.00	0.000	0.0	0.05	0.0
UNIDENTIFIED C5 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	3	0.14	0.32	0.029	1.3	9	0.36	0.92	0.084	3.2	0.32	2.9
TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
MTBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLPENTANE	7	0.31	0.71	0.011	0.5	6	0.26	0.67	0.010	0.4	0.26	0.4
4-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXANE	6	0.26	0.59	0.006	0.3	10	0.40	1.03	0.010	0.4	0.38	0.4

UNIDENTIFIED C6 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	3	0.12	0.28	0.004	0.2	8	0.33	0.86	0.012	0.5	0.30	0.4
METHYLCYCLOPENTANE, NOTE A	3	0.12	0.28	0.008	0.3	8	0.33	0.85	0.024	0.9	0.30	0.8
2,4-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLBUTANE	1	0.04	0.08	0.001	0.0	0	0.00	0.00	0.000	0.0	trace	0.0
3,4-DIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BENZENE	23	0.97	2.21	0.009	0.4	20	0.83	2.15	0.009	0.3	0.85	0.4
3-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	4	0.16	0.36	0.003	0.1	0	0.00	0.00	0.000	0.0	0.02	0.0
2-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEPTANE	7	0.30	0.68	0.006	0.2	10	0.39	1.02	0.008	0.3	0.38	0.3
CIS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C7	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	6	0.24	0.54	0.030	1.3	0	0.00	0.00	0.000	0.0	0.03	0.2
2,4,4-TRIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	5	0.22	0.51	0.008	0.4	0	0.00	0.00	0.000	0.0	0.03	0.1
2,3,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TOLUENE	55	2.32	5.28	0.144	6.3	11	0.44	1.13	0.031	1.2	0.70	1.9
2,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,2-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEXANE, NOTE B	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	5	0.22	0.58	0.007	0.3	0.19	0.2
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-4-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
OCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C8	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
m-& p-XYLENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-ETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
STYRENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
o-XYLENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

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CIS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NONANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
n-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,5-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-DECENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DECANE, NOTE F	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOBUTYLBENZENE, NOTE F	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,-DIMETHYL-5-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
INDAN	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2 DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNDECANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUT-2-METHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,4-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
N-PENT-BENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUT-3,5-DIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUTYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NAPHTHALENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DODECANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,5-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
FORMALDEHYDE	232	9.74	22.19	1.587	69.6	214	8.86	23.03	1.647	63.4	8.99	64.3
ACETALDEHYDE	84	3.53	8.04	0.444	19.5	72	2.97	7.72	0.426	16.4	3.05	16.8
ACROLEIN	65	2.74	6.25	0.423	18.6	67	2.76	7.17	0.485	18.7	2.76	18.7
ACETONE	24	0.99	2.26	0.013	0.6	11	0.45	1.16	0.006	0.2	0.52	0.3
PROPIONALDEHYDE	31	1.28	2.92	0.191	8.4	34	1.42	3.70	0.241	9.3	1.40	9.2
CROTONALDEHYDE	17	0.72	1.65	0.089	3.9	15	0.63	1.64	0.089	3.4	0.64	3.5

ISOBUTYRALDEHYDE, NOTE H	11	0.46	1.05	0.055	2.4	9	0.36	0.94	0.050	1.9	0.38	2.0
METHYL ETHYL KETONE, NOTE H	11	0.46	1.05	0.012	0.5	9	0.36	0.94	0.011	0.4	0.38	0.4
BENZALDEHYDE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOVALERALDEHYDE	15	0.62	1.41	0.062	2.7	21	0.85	2.22	0.098	3.8	0.82	3.6
VALERALDEHYDE	8	0.31	0.72	0.032	1.4	8	0.34	0.87	0.038	1.5	0.33	1.5
O-TOLUALDEHYDE	17	0.70	1.59	-0.009	-0.4	11	0.46	1.19	-0.007	-0.3	0.49	-0.3
M/P-TOLUALDEHYDE	32	1.35	3.09	-0.017	-0.7	34	1.42	3.68	-0.020	-0.8	1.41	-0.8
HEXANALDEHYDE	21	0.87	1.98	0.075	3.3	22	0.90	2.35	0.089	3.4	0.90	3.4
DIMETHYLBENZALDEHYDE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
SUMMED SPECIATED VALUES	1046	44	100	6	243	955	40	100	6	222	40	225

A - 2,2-Dimethylpentane and methylcyclopentane co-elute GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

BAG CART VALUES												
HC	558	23				70	3				6	
CO	12116	508				9736	403				418	
CO2	14117000	592156				13096000	542502				549595	
NOX	127990	5369				123483	5115				5151	

TEST NUMBER: 1-SME-3
ENGINE: 1997 CUMMINS N-14
TEST DATE: 11/19/97
TEST FUEL: EM-2481-F

	COLD					HOT					COMPOSITE	
COMPOUND	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	14	0.60			0.0	19	0.78			0.0	0.75	0.0
ETHANE	6	0.23	0.46	0.001	0.1	1	0.06	0.16	0.000	0.0	0.08	0.0
ETHYLENE	225	9.37	18.69	1.362	68.3	196	8.08	22.04	1.607	58.9	8.26	60.2
PROPANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYLENE	39	1.57	3.13	0.294	14.8	34	1.41	3.85	0.362	13.3	1.43	13.5
ACETYLENE	42	1.74	3.47	0.017	0.9	35	1.43	3.91	0.020	0.7	1.48	0.7
PROPADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BUTANE	4	0.17	0.35	0.004	0.2	0	0.00	0.00	0.000	0.0	0.02	0.0
TRANS-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTENE	17	0.72	1.44	0.128	6.4	18	0.73	1.99	0.177	6.5	0.73	6.5
2-METHYLPROPENE (ISOBUTYLENE)	5	0.22	0.44	0.023	1.2	6	0.25	0.67	0.036	1.3	0.24	1.3
2,2-DIMETHYLPROPANE (NEOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYNE	3	0.11	0.22	0.009	0.4	0	0.00	0.00	0.000	0.0	0.02	0.1
1,3-BUTADIENE	30	1.26	2.51	0.274	13.7	29	1.21	3.29	0.359	13.1	1.22	13.2
2-METHYLPROPANE (ISOBUTANE)	3	0.12	0.23	0.003	0.1	0	0.00	0.00	0.000	0.0	0.02	0.0
1-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	1	0.02	0.04	0.001	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PENTANE	6	0.23	0.46	0.005	0.2	0	0.00	0.00	0.000	0.0	0.03	0.0
UNIDENTIFIED C5 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	6	0.24	0.48	0.044	2.2	3	0.14	0.38	0.035	1.3	0.16	1.4
TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
MTBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLPENTANE	3	0.11	0.22	0.003	0.2	0	0.00	0.00	0.000	0.0	0.02	0.0
4-METHYL-TRANS-2-PENTENE	10	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLPENTANE	7	0.28	0.56	0.008	0.4	0	0.00	0.00	0.000	0.0	0.04	0.1
2-METHYL-1-PENTENE	3	0.12	0.24	0.011	0.5	0	0.00	0.00	0.000	0.0	0.02	0.1
1-HEXENE	3	0.12	0.24	0.011	0.5	0	0.00	0.00	0.000	0.0	0.02	0.1
HEXANE	11	0.46	0.91	0.009	0.4	10	0.43	1.17	0.011	0.4	0.43	0.4

UNIDENTIFIED C6 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	1	0.04	0.08	0.001	0.1	2	0.08	0.22	0.003	0.1	0.07	0.1
METHYLCYCLOPENTANE, NOTE A	1	0.04	0.08	0.002	0.1	2	0.08	0.21	0.006	0.2	0.07	0.2
2,4-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLBUTANE	2	0.10	0.20	0.003	0.1	1	0.02	0.06	0.001	0.0	0.03	0.0
3,4-DIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
I-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BENZENE	20	0.86	1.71	0.007	0.4	21	0.88	2.40	0.010	0.4	0.88	0.4
3-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXENE	6	0.26	0.52	0.030	1.5	6	0.24	0.65	0.037	1.4	0.24	1.4
3-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	2	0.08	0.16	0.001	0.1	4	0.17	0.46	0.004	0.2	0.16	0.1
2-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEPTANE	5	0.21	0.42	0.003	0.2	11	0.44	1.19	0.010	0.4	0.41	0.3
CIS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C7	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	7	0.27	0.55	0.030	1.5	10	0.40	1.10	0.061	2.2	0.38	2.1
2,4,4-TRIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TOLUENE	156	6.52	13.00	0.355	17.8	4	0.18	0.49	0.013	0.5	1.08	3.0
2,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,2-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEXANE, NOTE B	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	5	0.23	0.62	0.006	0.2	0.19	0.2
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-4-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
OCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C8	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
m-& p-XYLENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-ETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
STYRENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
o-XYLENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

CIS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NONANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
n-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,5-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-DECENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DECANE, NOTE F	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOBUTYLBENZENE, NOTE F	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,-DIMETHYL-5-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
INDAN	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2 DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNDECANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUT-2-METHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,4-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
N-PENT-BENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUT-3,5-DIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-1-BUTYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NAPHTHALENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DODECANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3,5-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
FORMALDEHYDE	243	10.15	20.24	1.447	72.6	205	8.49	23.16	1.656	60.7	8.72	62.4
ACETALDEHYDE	88	3.67	7.32	0.404	20.3	71	2.93	8.00	0.442	16.2	3.04	16.8
ACROLEIN	69	2.90	5.78	0.391	19.6	60	2.48	6.75	0.457	16.8	2.54	17.2
ACETONE	26	1.07	2.12	0.012	0.6	10	0.41	1.13	0.006	0.2	0.51	0.3
PROPIONALDEHYDE	27	1.12	2.23	0.146	7.3	25	1.02	2.79	0.182	6.7	1.04	6.8
CROTONALDEHYDE	30	1.25	2.48	0.135	6.8	18	0.74	2.01	0.109	4.0	0.81	4.4

ISOBUTYRALDEHYDE, NOTE H	8	0.32	0.64	0.034	1.7	7	0.28	0.77	0.041	1.5	0.29	1.5
METHYL ETHYL KETONE, NOTE H	8	0.32	0.64	0.008	0.4	7	0.28	0.77	0.009	0.3	0.29	0.3
BENZALDEHYDE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOVALERALDEHYDE	18	0.74	1.47	0.065	3.3	15	0.61	1.66	0.073	2.7	0.63	2.8
VALERALDEHYDE	4	0.16	0.32	0.014	0.7	4	0.16	0.44	0.019	0.7	0.16	0.7
O-TOLUALDEHYDE	7	0.30	0.59	-0.003	-0.2	8	0.31	0.86	-0.005	-0.2	0.31	-0.2
M/P-TOLUALDEHYDE	41	1.70	3.40	-0.019	-0.9	39	1.60	4.37	-0.024	-0.9	1.62	-0.9
HEXANALDEHYDE	23	0.98	1.95	0.074	3.7	21	0.89	2.42	0.092	3.4	0.90	3.4
DIMETHYLBENZALDEHYDE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
SUMMED SPECIATED VALUES	1216	51	100	5	268	906	37	100	6	213	39	221

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

BAG CART VALUES												
HC	815	34				633	26				27	
CO	12958	541				8976	371				395	
CO2	13924000	581135				13666000	564477				566857	
NOX	129277	5396				125978	5204				5231	

TEST NUMBER: 1-2D-1
ENGINE: 1997 CUMMINS N-14
TEST DATE: 11/24/97
TEST FUEL: EM-2494-F

	COLD					HOT					COMPOSITE	
COMPOUND	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0	0.00			0.0	0	0.00			0.0	0.00	0.0
ETHANE	2	0.06	0.07	0.000	0.0	4	0.15	0.21	0.001	0.0	0.14	0.0
ETHYLENE	306	11.64	13.86	1.010	84.8	274	10.24	14.39	1.049	74.6	10.44	76.1
PROPANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYLENE	97	3.69	4.39	0.413	34.7	92	3.44	4.83	0.454	32.3	3.47	32.6
ACETYLENE	59	2.24	2.66	0.013	1.1	49	1.84	2.59	0.013	0.9	1.90	0.9
PROPADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BUTANE	4	0.15	0.18	0.002	0.2	6	0.22	0.31	0.003	0.2	0.21	0.2
TRANS-2-BUTENE	5	0.19	0.22	0.022	1.9	4	0.16	0.22	0.022	1.6	0.16	1.6
1-BUTENE	29	1.12	1.33	0.119	10.0	29	1.07	1.50	0.134	9.5	1.08	9.6
2-METHYLPROPENE (ISOBUTYLENE)	27	1.04	1.24	0.066	5.5	25	0.93	1.30	0.069	4.9	0.94	5.0
2,2-DIMETHYLPROPANE (NEOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYNE	6	0.22	0.26	0.011	0.9	5	0.20	0.28	0.012	0.8	0.20	0.8
1,3-BUTADIENE	36	1.37	1.64	0.178	15.0	36	1.35	1.90	0.206	14.7	1.35	14.7
2-METHYLPROPANE (ISOBUTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-BUTENE	4	0.17	0.20	0.020	1.7	4	0.14	0.20	0.019	1.4	0.14	1.4
3-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	3	0.13	0.15	0.002	0.2	0	0.00	0.00	0.000	0.0	0.02	0.0
2-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-BUTENE	7	0.26	0.31	0.015	1.3	0	0.00	0.00	0.000	0.0	0.04	0.2
PENTANE	3	0.12	0.14	0.001	0.1	2	0.08	0.11	0.001	0.1	0.08	0.1
UNIDENTIFIED C5 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	6	0.21	0.29	0.013	0.9	0.18	0.8
3-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
MTBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLPENTANE	7	0.28	0.34	0.005	0.4	6	0.24	0.34	0.005	0.4	0.25	0.4
4-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLPENTANE	11	0.42	0.50	0.008	0.6	6	0.22	0.31	0.005	0.3	0.25	0.4
2-METHYL-1-PENTENE	14	0.52	0.61	0.027	2.3	13	0.50	0.70	0.031	2.2	0.50	2.2
1-HEXENE	14	0.52	0.61	0.027	2.3	13	0.50	0.70	0.031	2.2	0.50	2.2
HEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

UNIDENTIFIED C6 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOPENTANE, NOTE A	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BENZENE	33	1.24	1.48	0.006	0.5	20	0.75	1.05	0.004	0.3	0.82	0.3
3-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	13	0.50	0.60	0.006	0.5	13	0.48	0.68	0.006	0.4	0.48	0.4
2-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C7	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOHEXANE	6	0.24	0.28	0.005	0.4	6	0.21	0.29	0.005	0.4	0.21	0.4
CIS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	7	0.28	0.33	0.005	0.4	0	0.00	0.00	0.000	0.0	0.04	0.1
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TOLUENE	34	1.28	1.53	0.042	3.5	21	0.80	1.12	0.031	2.2	0.87	2.4
2,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,2-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEXANE, NOTE B	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,5-TRIMETHYLHEXANE	5	0.20	0.24	0.002	0.2	0	0.00	0.00	0.000	0.0	0.03	0.0
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	9	0.34	0.41	0.008	0.7	10	0.37	0.52	0.010	0.7	0.37	0.7
1,1-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-4-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
OCTANE	7	0.27	0.32	0.002	0.2	8	0.29	0.41	0.002	0.2	0.29	0.2
UNIDENTIFIED C8	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	14	0.52	0.62	0.007	0.6	17	0.62	0.87	0.010	0.7	0.60	0.7
1,1,3-TRIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	5	0.20	0.24	0.003	0.2	6	0.22	0.31	0.004	0.3	0.22	0.2
3,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLBENZENE	21	0.81	0.96	0.026	2.2	18	0.67	0.95	0.026	1.8	0.69	1.9
2,3,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
m-& p-XYLENE	45	1.69	2.01	0.149	12.5	22	0.83	1.17	0.086	6.1	0.96	7.0
4-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-ETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLOCTANE	10	0.39	0.46	0.005	0.4	7	0.27	0.38	0.004	0.3	0.29	0.3
3-METHYLOCTANE	5	0.21	0.24	0.003	0.2	6	0.23	0.32	0.004	0.3	0.23	0.3
STYRENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
o-XYLENE	15	0.57	0.68	0.044	3.7	10	0.36	0.51	0.033	2.3	0.39	2.5
1-NONENE	11	0.43	0.51	0.011	1.0	0	0.00	0.00	0.000	0.0	0.06	0.1
TRANS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

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CIS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NONANE	19	0.72	0.86	0.005	0.4	18	0.69	0.97	0.005	0.4	0.69	0.4
TRANS-2-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0 00	0.000	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	0	0.00	0.00	0.000	0.0	5	0.17	0.25	0.006	0.4	0.15	0.3
2,2-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0 000	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	8	0.29	0.35	0.003	0.3	8	0.30	0.42	0.004	0.3	0 29	0.3
n-PROPYLBENZENE	9	0 34	0.40	0.009	0.7	9	0.33	0.46	0.010	0.7	0.33	0.7
1-METHYL-3-ETHYLBENZENE	7	0 25	0.30	0.022	1.8	6	0.23	0.32	0.023	1.7	0.23	1.7
1-METHYL-4-ETHYLBENZENE	12	0 47	0.56	0.040	3.4	7	0.27	0.38	0.028	2.0	0.30	2.2
1,3,5-TRIMETHYLBENZENE	13	0.51	0.61	0.062	5.2	11	0.40	0.57	0.058	4.1	0.42	4.2
1-METHYL-2-ETHYLBENZENE	5	0.21	0.25	0.018	1.5	12	0.46	0.65	0.047	3.3	0.42	3.0
1,2,4-TRIMETHYLBENZENE	12	0.47	0.56	0.050	4.2	0	0.00	0.00	0.000	0.0	0 07	0.6
TERT-BUTYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-DECENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DECANE, NOTE F	14	0.54	0.64	0.003	0.3	14	0.52	0.73	0.003	0.2	0.52	0.2
ISOBUTYLBENZENE, NOTE F	13	0.51	0.60	0.011	0.9	13	0.49	0.68	0.013	0.9	0.49	0.9
1,3,-DIMETHYL-5-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0 000	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0 0
1-METHYL-3-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	8	0.32	0.38	0.034	2.8	7	0.27	0.38	0.034	2.4	0.28	2.5
1-METHYL-4-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
INDAN	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	5	0.19	0.22	0.013	1.1	0	0.00	0.00	0.000	0.0	0.03	0.2
1,3-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0	0.00	0.00	0.000	0.0	5	0.18	0.25	0.016	1.1	0.15	1.0
1,2 DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	8	0.29	0.41	0.026	1.9	0.25	1.6
1,4-DIMETHYL-2-ETHYLBENZENE	0	0 00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	6	0.24	0.29	0.026	2.2	0	0.00	0.00	0.000	0.0	0.03	0.3
1,2-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0 0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNDECANE	49	1.87	2.23	0.009	0.8	46	1 70	2.39	0.010	0.7	1.72	0.7
1,2-DIMETHYL-3-ETHYLBENZENE	0	0 00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	37	1.42	1.69	0.154	12.9	62	2.31	3.25	0.295	21.0	2.19	19.8
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	22	0.83	0.98	0.089	7.5	0	0.00	0.00	0.000	0.0	0.12	1.1
TERT-1-BUT-2-METHYLBENZENE	14	0.53	0.64	0.037	3.1	15	0.56	0.78	0.046	3.2	0.55	3.2
1,2,3,4-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
N-PENT-BENZENE	16	0.61	0.72	0.012	1.0	16	0.58	0.82	0.014	1.0	0.59	1.0
TERT-1-BUT-3,5-DIMETHYLBENZENE	6	0.25	0.29	0.022	1.8	6	0.24	0.34	0.025	1.8	0.24	1.8
TERT-1-BUTYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NAPHTHALENE	6	0.22	0.26	0.003	0.3	6	0.23	0.32	0.004	0.3	0.23	0.3
DODECANE	35	1.32	1.58	0.006	0.5	40	1.50	2.11	0.008	0.6	1.47	0.6
1,3,5-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	131	4.99	5.94	0.226	19.0	94	3.50	4.92	0.188	13.3	3.71	14.2
FORMALDEHYDE	378	14.34	17.09	1.222	102.6	338	12.62	17.74	1.268	90.2	12.86	92.0
ACETALDEHYDE	158	6.01	7.16	0.395	33.2	122	4.57	6.43	0.355	25.2	4.78	26.4
ACROLEIN	48	1.83	2.18	0.146	12.4	43	1.62	2.27	0.154	10.9	1.65	11.1
ACETONE	55	2.08	2.48	0.014	1.2	35	1.29	1.82	0.010	0.7	1.40	0.8
PROPIONALDEHYDE	41	1.55	1.85	0.121	10.2	31	1.17	1.65	0.108	7.7	1.23	8.0
CROTONALDEHYDE	37	1 42	1.69	0.092	7.7	46	1.71	2.41	0.130	9.3	1.67	9.1

ISOBUTYRALDEHYDE, NOTE H	13	0.50	0.60	0.031	2.6	11	0.40	0.56	0.029	2.1	0.41	2.2
METHYL ETHYL KETONE, NOTE H	13	0.50	0.60	0.007	0.6	11	0.40	0.56	0.007	0.5	0.41	0.5
BENZALDEHYDE	18	0.68	0.81	-0.004	-0.4	15	0.54	0.76	-0.004	-0.3	0.56	-0.3
ISOVALERALDEHYDE	14	0.52	0.62	0.028	2.3	17	0.62	0.87	0.038	2.7	0.60	2.7
VALERALDEHYDE	11	0.40	0.48	0.021	1.8	10	0.36	0.50	0.022	1.6	0.36	1.6
O-TOLUALDEHYDE	4	0.17	0.20	-0.001	-0.1	10	0.37	0.52	-0.003	-0.2	0.34	-0.2
M/P-TOLUALDEHYDE	74	2.81	3.34	-0.018	-1.5	52	1.95	2.74	-0.015	-1.1	2.07	-1.1
HEXANALDEHYDE	14	0.52	0.62	0.024	2.0	12	0.44	0.63	0.024	1.7	0.46	1.7
DIMETHYLBENZALDEHYDE	7	0.25	0.29	-0.002	-0.1	7	0.26	0.37	-0.002	-0.1	0.26	-0.1
SUMMED SPECIATED VALUES	2211	84	100	5	436	1906	71	100	5	375	73	384

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

BAG CART VALUES												
HC	5551	211				5401	202				203	
CO	24481	930				18118	676				712	
CO2	14843000	563730				14221000	530634				535362	
NOX	128972	4898				120513	4497				4554	

TEST NUMBER: 1-2D-2
ENGINE: 1997 CUMMINS N-14
TEST DATE: 11/25/97
TEST FUEL: EM-2494-F

	COLD					HOT					COMPOSITE	
COMPOUND	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0	0.00			0.0	0	0.00			0.0	0.00	0.0
ETHANE	0	0.00	0.00	0.000	0.0	4	0.13	0.16	0.000	0.0	0.12	0.0
ETHYLENE	309	11.62	14.41	1.051	84.7	289	10.76	13.17	0.960	78.4	10.88	79.3
PROPANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYLENE	96	3.63	4.50	0.423	34.1	96	3.56	4.36	0.410	33.5	3.57	33.6
ACETYLENE	58	2.17	2.69	0.013	1.1	51	1.91	2.34	0.012	1.0	1.95	1.0
PROPADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BUTANE	0	0.00	0.00	0.000	0.0	0	0.02	0.02	0.000	0.0	trace	0.0
TRANS-2-BUTENE	5	0.18	0.22	0.022	1.7	5	0.18	0.22	0.022	1.8	0.18	1.8
1-BUTENE	29	1.10	1.37	0.122	9.8	31	1.15	1.41	0.126	10.3	1.15	10.2
2-METHYLPROPENE (ISOBUTYLENE)	25	0.93	1.15	0.061	4.9	24	0.88	1.07	0.057	4.6	0.88	4.7
2,2-DIMETHYLPROPANE (NEOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYNE	6	0.22	0.28	0.011	0.9	5	0.19	0.23	0.010	0.8	0.19	0.8
1,3-BUTADIENE	35	1.31	1.63	0.177	14.3	36	1.34	1.64	0.178	14.6	1.33	14.5
2-METHYLPROPANE (ISOBUTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-BUTENE	3	0.12	0.15	0.015	1.2	3	0.12	0.15	0.015	1.2	0.12	1.2
3-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-BUTENE	6	0.23	0.29	0.014	1.1	7	0.26	0.32	0.016	1.3	0.26	1.3
PENTANE	0	trace	0.00	0.000	0.0	3	0.11	0.14	0.001	0.1	0.10	0.1
UNIDENTIFIED C5 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-PENTENE	5	0.18	0.23	0.020	1.6	0	0.00	0.00	0.000	0.0	0.03	0.2
3,3-DIMETHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-PENTENE	6	0.24	0.29	0.026	2.1	0	0.00	0.00	0.000	0.0	0.03	0.3
2-METHYL-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTENE	0	0.00	0.00	0.000	0.0	7	0.25	0.30	0.023	1.9	0.21	1.6
4-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	8	0.29	0.35	0.016	1.3	0.25	1.1
3-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	trace	0.00	0.000	0.0	trace	0.0
MTBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLPENTANE	1	0.04	0.05	0.001	0.1	6	0.21	0.26	0.004	0.3	0.19	0.3
4-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLPENTANE	2	0.09	0.11	0.002	0.1	5	0.19	0.23	0.004	0.3	0.18	0.3
2-METHYL-1-PENTENE	15	0.56	0.69	0.031	2.5	13	0.50	0.61	0.027	2.2	0.51	2.3
1-HEXENE	15	0.56	0.69	0.031	2.5	13	0.50	0.61	0.027	2.2	0.51	2.3
HEXANE	0	0.00	0.00	0.000	0.0	1	0.03	0.04	0.000	0.0	0.03	0.0

UNIDENTIFIED C6 OLEFINS	5	0.20	0.25	0.017	1.4	7	0.25	0.30	0.020	1.6	0.24	1.6
TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOPENTANE, NOTE A	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BENZENE	28	1.04	1.29	0.005	0.4	30	1.13	1.39	0.006	0.5	1.12	0.5
3-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	11	0.41	0.51	0.005	0.4	8	0.28	0.34	0.003	0.3	0.30	0.3
2-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEPTANE	5	0.20	0.24	0.002	0.2	0	0.00	0.00	0.000	0.0	0.03	0.0
CIS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C7	0	0.00	0.00	0.000	0.0	5	0.20	0.24	0.011	0.9	0.17	0.8
2-METHYL-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOHEXANE	7	0.26	0.33	0.006	0.5	6	0.24	0.29	0.005	0.4	0.24	0.4
CIS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	8	0.29	0.36	0.005	0.4	0.25	0.4
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

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1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	7	0.25	0.31	0.005	0.4	2	0.08	0.10	0.002	0.1	0.11	0.2
2,3,3-TRIMETHYLPENTANE	1	0.03	0.04	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TOLUENE	51	1.90	2.36	0.064	5.2	19	0.70	0.86	0.024	1.9	0.88	2.4
2,3-DIMETHYLHEXANE	5	0.17	0.22	0.003	0.2	6	0.24	0.29	0.004	0.3	0.23	0.3
1,1,2-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEXANE, NOTE B	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLHEXANE	0	0.00	0.00	0.000	0.0	5	0.20	0.24	0.003	0.2	0.17	0.2
2,2,5-TRIMETHYLHEXANE	6	0.21	0.26	0.003	0.2	0	0.00	0.00	0.000	0.0	0.03	0.0
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	5	0.19	0.24	0.003	0.2	0.17	0.2
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	13	0.47	0.59	0.011	0.9	14	0.51	0.62	0.012	1.0	0.50	1.0
1,1-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-4-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
OCTANE	7	0.27	0.33	0.002	0.2	9	0.33	0.41	0.002	0.2	0.32	0.2
UNIDENTIFIED C8	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	17	0.62	0.77	0.009	0.7	18	0.67	0.82	0.009	0.8	0.66	0.8
1,1,3-TRIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	6	0.24	0.30	0.003	0.3	7	0.25	0.31	0.004	0.3	0.25	0.3
3,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLBENZENE	20	0.76	0.95	0.026	2.1	21	0.80	0.97	0.026	2.1	0.79	2.1
2,3,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
m-& p-XYLENE	21	0.79	0.98	0.073	5.8	26	0.97	1.18	0.087	7.1	0.94	6.9
4-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-ETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLOCTANE	0	0.00	0.00	0.000	0.0	9	0.35	0.43	0.005	0.4	0.30	0.3
3-METHYLOCTANE	5	0.19	0.24	0.003	0.2	7	0.27	0.34	0.004	0.3	0.26	0.3
STYRENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
o-XYLENE	10	0.38	0.47	0.030	2.4	10	0.37	0.45	0.029	2.4	0.37	2.4
1-NONENE	10	0.39	0.49	0.011	0.9	6	0.23	0.28	0.006	0.5	0.25	0.6
TRANS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

TEST NUMBER: 1-2D-3
ENGINE: 1997 CUMMINS N-14
TEST DATE: 11/26/97
TEST FUEL: EM-2494-F

	COLD					HOT					COMPOSITE	
COMPOUND	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG	MG/BHP-HR	WEIGHT NMOG %	WT. NMOG REACTIVITY FACTOR	OZONE, MG/BHP-HR	MG/BHP-HR	OZONE, MG/BHP-HR
METHANE	0	0.00			0.0	0	0.00			0.0	0.00	0.0
ETHANE	1	0.04	0.05	0.000	0.0	0	0.00	0.00	0.000	0.0	trace	0.0
ETHYLENE	305	11.54	14.87	1.084	84.2	274	10.28	13.29	0.969	75.0	10.46	76.3
PROPANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYLENE	96	3.62	4.66	0.438	34.0	93	3.50	4.52	0.425	32.9	3.51	33.0
ACETYLENE	58	2.19	2.82	0.014	1.1	50	1.87	2.42	0.012	0.9	1.92	1.0
PROPADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BUTANE	2	0.06	0.08	0.001	0.1	0	0.00	0.00	0.000	0.0	trace	0.0
TRANS-2-BUTENE	5	0.17	0.22	0.022	1.7	5	0.18	0.23	0.023	1.8	0.18	1.8
1-BUTENE	29	1.10	1.42	0.126	9.8	29	1.11	1.43	0.127	9.9	1.11	9.8
2-METHYLPROPENE (ISOBUTYLENE)	25	0.96	1.23	0.065	5.1	21	0.79	1.02	0.054	4.2	0.81	4.3
2,2-DIMETHYLPROPANE (NEOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
PROPYNE	6	0.21	0.27	0.011	0.9	5	0.20	0.26	0.011	0.8	0.20	0.8
1,3-BUTADIENE	35	1.33	1.71	0.186	14.5	34	1.28	1.66	0.180	14.0	1.29	14.0
2-METHYLPROPANE (ISOBUTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-BUTENE	3	0.13	0.17	0.017	1.3	3	0.13	0.17	0.017	1.3	0.13	1.3
3-METHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLBUTANE (ISOPENTANE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-BUTYNE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1-BUTENE	7	0.26	0.33	0.016	1.3	6	0.21	0.27	0.013	1.0	0.21	1.0
PENTANE	1	0.03	0.04	0.000	0.0	2	0.07	0.09	0.001	0.1	0.06	0.1
UNIDENTIFIED C5 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-1,3-BUTADIENE	5	0.20	0.25	0.023	1.8	0	0.00	0.00	0.000	0.0	0.03	0.3
TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYL-1-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-PENTENE	7	0.26	0.33	0.029	2.3	6	0.21	0.27	0.024	1.9	0.22	1.9
2-METHYL-2-BUTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-BUTANOL	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTADIENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	5	0.20	0.26	0.002	0.2	0.17	0.1
CYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLBUTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
MTBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLPENTANE	0	0.00	0.00	0.000	0.0	3	0.09	0.12	0.002	0.1	0.08	0.1
4-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLPENTANE	1	0.04	0.06	0.001	0.1	5	0.19	0.24	0.004	0.3	0.17	0.3
2-METHYL-1-PENTENE	14	0.54	0.70	0.031	2.4	16	0.61	0.79	0.035	2.7	0.60	2.7
1-HEXENE	14	0.54	0.70	0.031	2.4	16	0.61	0.79	0.035	2.7	0.60	2.7
HEXANE	0	0.02	0.02	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

UNIDENTIFIED C6 OLEFINS	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DI-ISOPROPYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETBE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLPENTANE, NOTE A	0	0.00	0.00	0.000	0.0	3	0.11	0.14	0.002	0.2	0.10	0.1
METHYLCYCLOPENTANE, NOTE A	0	0.00	0.00	0.000	0.0	3	0.11	0.14	0.004	0.3	0.09	0.3
2,4-DIMETHYLPENTANE	3	0.13	0.17	0.003	0.2	0	0.00	0.00	0.000	0.0	0.02	0.0
2,2,3-TRIMETHYLBUTANE	0	trace	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	trace	0.0
3,4-DIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYLCYCLOPENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
BENZENE	36	1.35	1.74	0.007	0.6	20	0.76	0.98	0.004	0.3	0.85	0.4
3-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLPENTANE	6	0.23	0.29	0.002	0.2	0	0.00	0.00	0.000	0.0	0.03	0.0
CYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLPENTANE	0	0.02	0.02	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TERT-AMYL METHYL ETHER	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CYCLOHEXENE	0	trace	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	trace	0.0
3-METHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLPENTANE	0	0.00	0.00	0.000	0.0	1	0.06	0.07	0.001	0.1	0.05	0.1
TRANS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOPENTANE	5	0.20	0.26	0.007	0.5	0	0.00	0.00	0.000	0.0	0.03	0.1
1-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLPENTANE	5	0.20	0.25	0.002	0.2	4	0.14	0.18	0.002	0.1	0.14	0.1
2-METHYL-1-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEPTANE	0	0.00	0.00	0.000	0.0	2	0.08	0.10	0.001	0.1	0.07	0.1
CIS-3-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C7	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYL-2-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYL-TRANS-3-HEXENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYL-CIS-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-1-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-HEPTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLCYCLOHEXANE	3	0.11	0.15	0.003	0.2	4	0.15	0.19	0.004	0.3	0.15	0.3
CIS-1,2-DIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,1,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYL-2-PENTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,3-TRIMETHYLPENTANE	5	0.24	0.30	0.004	0.3	2	0.06	0.08	0.001	0.1	0.09	0.1
2,5-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEXANE	1	0.04	0.05	0.001	0.1	4	0.16	0.21	0.003	0.2	0.14	0.2
1-TRANS-2-CIS-4-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,3-DIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

CIS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NONANE	19	0.70	0.87	0.005	0.4	20	0.76	0.93	0.005	0.4	0.75	0.4
TRANS-2-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	6	0.24	0.29	0.007	0.5	0	0.00	0.00	0.000	0.0	0.03	0.1
2,2-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	8	0.29	0.36	0.004	0.3	8	0.29	0.35	0.004	0.3	0.29	0.3
n-PROPYLBENZENE	8	0.30	0.37	0.008	0.6	5	0.18	0.22	0.005	0.4	0.20	0.4
1-METHYL-3-ETHYLBENZENE	15	0.55	0.68	0.049	3.9	14	0.51	0.63	0.045	3.7	0.52	3.7
1-METHYL-4-ETHYLBENZENE	10	0.36	0.44	0.032	2.6	10	0.39	0.48	0.034	2.8	0.38	2.8
1,3,5-TRIMETHYLBENZENE	11	0.41	0.50	0.051	4.1	12	0.43	0.53	0.053	4.3	0.43	4.3
1-METHYL-2-ETHYLBENZENE	10	0.37	0.46	0.033	2.6	11	0.41	0.50	0.036	2.9	0.40	2.9
1,2,4-TRIMETHYLBENZENE	22	0.81	1.00	0.089	7.1	20	0.76	0.93	0.082	6.7	0.76	6.7
TERT-BUTYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-DECENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DECANE, NOTE F	16	0.59	0.73	0.003	0.3	13	0.48	0.59	0.003	0.2	0.50	0.2
ISOBUTYLBENZENE, NOTE F	15	0.56	0.69	0.013	1.0	12	0.45	0.55	0.010	0.8	0.47	0.9
1,3,-DIMETHYL-5-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	5	0.20	0.25	0.005	0.4	0	0.00	0.00	0.000	0.0	0.03	0.1
1-METHYL-3-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	12	0.44	0.54	0.048	3.9	8	0.31	0.38	0.034	2.8	0.33	2.9
1-METHYL-4-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
INDAN	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	7	0.27	0.34	0.020	1.6	0	0.00	0.00	0.000	0.0	0.04	0.2
1,3-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIETHYLBENZENE	7	0.27	0.34	0.022	1.8	10	0.37	0.46	0.030	2.4	0.36	2.3
1-METHYL-3-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	5	0.19	0.23	0.015	1.2	0.16	1.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0	0.00	0.00	0.000	0.0	15	0.57	0.70	0.045	3.7	0.49	3.1
1,2 DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	5	0.20	0.25	0.016	1.3	7	0.27	0.33	0.021	1.8	0.26	1.7
1,4-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	10	0.38	0.47	0.043	3.4	12	0.45	0.55	0.050	4.1	0.44	4.0
1,2-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNDECANE	59	2.23	2.76	0.012	0.9	71	2.65	3.24	0.014	1.1	2.59	1.1
1,2-DIMETHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	11	0.42	0.52	0.048	3.8	23	0.87	1.06	0.096	7.9	0.80	7.3
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	18	0.67	0.83	0.075	6.1	14	0.53	0.64	0.058	4.8	0.55	5.0
TERT-1-BUT-2-METHYLBENZENE	9	0.34	0.42	0.025	2.0	11	0.40	0.49	0.028	2.3	0.39	2.3
1,2,3,4-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
N-PENT-BENZENE	17	0.63	0.78	0.013	1.1	21	0.79	0.97	0.016	1.3	0.77	1.3
TERT-1-BUT-3,5-DIMETHYLBENZENE	10	0.38	0.48	0.036	2.9	11	0.39	0.48	0.036	2.9	0.39	2.9
TERT-1-BUTYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NAPHTHALENE	5	0.21	0.26	0.003	0.2	7	0.26	0.31	0.004	0.3	0.25	0.3
DODECANE	34	1.30	1.61	0.006	0.5	47	1.74	2.13	0.008	0.7	1.67	0.6
1,3,5-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	110	4.14	5.13	0.196	15.8	148	5.53	6.76	0.258	21.1	5.33	20.3
FORMALDEHYDE	358	13.47	16.70	1.194	96.3	366	13.62	16.68	1.192	97.4	13.60	97.2
ACETALDEHYDE	127	4.77	5.91	0.326	26.3	123	4.59	5.61	0.310	25.3	4.61	25.5
ACROLEIN	33	1.24	1.54	0.104	8.4	30	1.13	1.39	0.094	7.7	1.15	7.8
ACETONE	41	1.53	1.90	0.011	0.9	37	1.39	1.70	0.010	0.8	1.41	0.8
PROPIONALDEHYDE	74	2.77	3.44	0.225	18.1	67	2.49	3.05	0.199	16.3	2.53	16.6
CROTONALDEHYDE	61	2.30	2.86	0.155	12.5	62	2.29	2.80	0.152	12.4	2.29	12.4

ISOBUTYRALDEHYDE, NOTE H	11	0.43	0.53	0.028	2.3	14	0.53	0.65	0.034	2.8	0.52	2.7
METHYL ETHYL KETONE, NOTE H	11	0.43	0.53	0.008	0.5	14	0.53	0.65	0.008	0.6	0.52	0.6
BENZALDEHYDE	12	0.46	0.58	-0.003	-0.3	13	0.48	0.58	-0.003	-0.3	0.47	-0.3
ISOVALERALDEHYDE	7	0.26	0.32	0.014	1.1	7	0.24	0.30	0.013	1.1	0.24	1.1
VALERALDEHYDE	13	0.47	0.59	0.026	2.1	9	0.34	0.42	0.018	1.5	0.36	1.6
O-TOLUALDEHYDE	8	0.29	0.36	-0.002	-0.2	9	0.32	0.39	-0.002	-0.2	0.32	-0.2
M/P-TOLUALDEHYDE	58	2.17	2.69	-0.015	-1.2	49	1.82	2.22	-0.012	-1.0	1.87	-1.0
HEXANALDEHYDE	10	0.38	0.47	0.018	1.4	9	0.35	0.43	0.016	1.3	0.36	1.3
DIMETHYLBENZALDEHYDE	11	0.42	0.53	-0.003	-0.2	13	0.47	0.58	-0.003	-0.3	0.47	-0.3
SUMMED SPECIATED VALUES	2144	81	100	5	422	2195	82	100	5	424	82	424

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

BAG CART VALUES												
HC	5518	209				7296	272				262	
CO	24522	922				19120	712				742	
CO2	15139000	569349				14946000	556234				558107	
NOX	129129	4856				120359	4479				4533	

CIS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NONANE	13	0.47	0.61	0.003	0.3	23	0.86	1.11	0.006	0.5	0.80	0.4
TRANS-2-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLBENZENE (CUMENE)	6	0.24	0.31	0.007	0.5	8	0.31	0.40	0.009	0.7	0.30	0.7
2,2-DIMETHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLOCTANE	11	0.41	0.53	0.005	0.4	9	0.35	0.45	0.005	0.4	0.36	0.4
n-PROPYLBENZENE	6	0.23	0.30	0.006	0.5	10	0.39	0.51	0.011	0.8	0.37	0.8
1-METHYL-3-ETHYLBENZENE	11	0.41	0.53	0.038	2.9	14	0.53	0.68	0.049	3.8	0.51	3.7
1-METHYL-4-ETHYLBENZENE	7	0.26	0.34	0.025	1.9	9	0.35	0.45	0.033	2.5	0.34	2.4
1,3,5-TRIMETHYLBENZENE	7	0.27	0.35	0.036	2.8	12	0.45	0.58	0.059	4.5	0.42	4.3
1-METHYL-2-ETHYLBENZENE	8	0.30	0.39	0.028	2.2	11	0.41	0.54	0.039	3.0	0.40	2.9
1,2,4-TRIMETHYLBENZENE	3	0.12	0.15	0.014	1.1	18	0.66	0.85	0.075	5.8	0.58	5.1
TERT-BUTYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-DECENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
DECANE, NOTE F	4	0.14	0.19	0.001	0.1	14	0.53	0.68	0.003	0.2	0.47	0.2
ISOBUTYLBENZENE, NOTE F	4	0.14	0.17	0.003	0.3	13	0.50	0.64	0.012	0.9	0.44	0.8
1,3,-DIMETHYL-5-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
METHYLPROPYLBENZENE (sec butylbenzene)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-3-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3-TRIMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-ISOPROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
INDAN	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-ISOPROPYLBENZENE	6	0.23	0.30	0.018	1.4	7	0.26	0.33	0.020	1.5	0.26	1.5
1,3-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,4-DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	7	0.26	0.33	0.021	1.7	0.22	1.4
1-METHYL-3-N-PROPYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-4-N-PROPYLBENZENE, NOTE G	0	0.00	0.00	0.000	0.0	8	0.30	0.39	0.025	1.9	0.26	1.7
1,2 DIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-2-N-PROPYLBENZENE	7	0.25	0.32	0.021	1.6	6	0.21	0.27	0.018	1.4	0.22	1.4
1,4-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2-DIMETHYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,3-DIMETHYL-2-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNDECANE	40	1.50	1.93	0.008	0.6	53	2.00	2.59	0.011	0.8	1.93	0.8
1,2-DIMETHYL-3-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4,5-TETRAMETHYLBENZENE	13	0.50	0.64	0.058	4.5	5	0.20	0.26	0.024	1.8	0.24	2.2
2-METHYLBUTYLBENZENE (sec AMYLBENZENE)	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4 DIMETHYLCUMENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,3,5-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	9	0.34	0.45	0.040	3.1	0.30	2.7
TERT-1-BUT-2-METHYLBENZENE	5	0.21	0.27	0.016	1.2	12	0.45	0.58	0.034	2.6	0.42	2.4
1,2,3,4-TETRAMETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
N-PENT-BENZENE	14	0.55	0.71	0.012	0.9	21	0.77	1.00	0.017	1.3	0.74	1.3
TERT-1-BUT-3,5-DIMETHYLBENZENE	7	0.28	0.36	0.027	2.1	6	0.23	0.30	0.023	1.8	0.24	1.8
TERT-1-BUTYL-4-ETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
NAPHTHALENE	11	0.43	0.56	0.007	0.5	10	0.37	0.47	0.006	0.4	0.37	0.4
DODECANE	46	1.81	2.34	0.009	0.7	46	1.72	2.23	0.008	0.7	1.74	0.7
1,3,5-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1,2,4-TRIETHYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
HEXYLBENZENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
UNIDENTIFIED C9-C12+	75	2.83	3.65	0.139	10.8	108	4.06	5.25	0.200	15.5	3.89	14.8
FORMALDEHYDE	380	14.38	18.53	1.325	102.8	360	13.50	17.45	1.247	96.5	13.62	97.4
ACETALDEHYDE	137	5.19	6.68	0.369	28.6	128	4.80	6.21	0.343	26.5	4.86	26.8
ACROLEIN	41	1.56	2.01	0.136	10.6	40	1.51	1.96	0.132	10.2	1.52	10.3
ACETONE	56	2.13	2.74	0.015	1.2	34	1.26	1.63	0.009	0.7	1.38	0.8
PROPIONALDEHYDE	52	1.96	2.52	0.165	12.8	64	2.41	3.12	0.204	15.7	2.35	15.3
CROTONALDEHYDE	53	1.99	2.56	0.139	10.8	49	1.85	2.39	0.130	10.0	1.87	10.1

1-TRANS-2-CIS-3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,4-TRIMETHYLPENTANE	2	0.06	0.08	0.001	0.1	0	0.00	0.00	0.000	0.0	trace	0.0
2,3,3-TRIMETHYLPENTANE	1	0.05	0.07	0.001	0.1	1	0.04	0.05	0.001	0.0	0.04	0.0
TOLUENE	50	1.89	2.44	0.067	5.2	11	0.42	0.54	0.015	1.2	0.63	1.7
2,3-DIMETHYLHEXANE	5	0.21	0.27	0.004	0.3	10	0.39	0.50	0.007	0.5	0.36	0.5
1,1,2-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	6	0.21	0.27	0.003	0.2	0.18	0.2
3,4-DIMETHYLHEXANE, NOTE B	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-METHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-CIS,2-TRANS,3-TRIMETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,3-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,4-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3-ETHYLHEXANE	0	0.00	0.00	0.000	0.0	7	0.28	0.36	0.004	0.3	0.24	0.3
2,2,5-TRIMETHYLHEXANE	7	0.25	0.32	0.003	0.2	8	0.31	0.40	0.004	0.3	0.30	0.3
TRANS-1-METHYL-3-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-3-ETHYLCYCLOPENTANE	13	0.49	0.62	0.012	0.9	16	0.58	0.75	0.015	1.1	0.57	1.1
1,1-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-METHYL-1-ETHYL-CYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
1-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-4-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
OCTANE	9	0.35	0.45	0.003	0.2	10	0.38	0.49	0.003	0.2	0.37	0.2
UNIDENTIFIED C8	0	0.00	0.00	0.000	0.0	6	0.23	0.30	0.010	0.8	0.20	0.7
TRANS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
TRANS-1,3-DIMETHYLCYCLOHEXANE, NOTE C	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-2-OCTENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ISOPROPYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,2-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3,5-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1-METHYL-2-ETHYLCYCLOPENTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
CIS-1,2-DIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,6-DIMETHYLHEPTANE, NOTE D	17	0.63	0.81	0.009	0.7	14	0.51	0.66	0.008	0.6	0.53	0.6
1,1,3-TRIMETHYLCYCLOHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,5-DIMETHYLHEPTANE, NOTE E	6	0.24	0.30	0.003	0.3	7	0.25	0.32	0.004	0.3	0.25	0.3
3,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,5-DIMETHYLHEPTANE, NOTE E	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
ETHYLBENZENE	21	0.81	1.04	0.028	2.2	24	0.89	1.15	0.031	2.4	0.88	2.4
2,3,4-TRIMETHYLHEXANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2,3-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
m-& p-XYLENE	28	1.07	1.37	0.101	7.9	31	1.16	1.50	0.111	8.6	1.15	8.5
4-METHYLOCTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
3,4-DIMETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
4-ETHYLHEPTANE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
2-METHYLOCTANE	7	0.28	0.36	0.004	0.3	10	0.37	0.48	0.005	0.4	0.36	0.4
3-METHYLOCTANE	5	0.19	0.24	0.003	0.2	8	0.28	0.36	0.004	0.3	0.27	0.3
STYRENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0
o-XYLENE	15	0.59	0.76	0.049	3.8	12	0.44	0.57	0.037	2.9	0.47	3.0
1-NONENE	12	0.46	0.59	0.013	1.0	9	0.33	0.42	0.009	0.7	0.35	0.8
TRANS-3-NONENE	0	0.00	0.00	0.000	0.0	0	0.00	0.00	0.000	0.0	0.00	0.0

ISOBUTYRALDEHYDE, NOTE H	12	0.44	0.57	0.030	2.3	16	0.58	0.76	0.040	3.1	0.56	3.0
METHYL ETHYL KETONE, NOTE H	12	0.44	0.57	0.007	0.5	16	0.58	0.76	0.009	0.7	0.56	0.7
BENZALDEHYDE	18	0.66	0.85	-0.005	-0.4	23	0.84	1.09	-0.006	-0.5	0.82	-0.5
ISOVALERALDEHYDE	8	0.31	0.40	0.018	1.4	8	0.28	0.37	0.016	1.3	0.29	1.3
VALERALDEHYDE	18	0.70	0.90	0.040	3.1	11	0.40	0.52	0.023	1.8	0.45	2.0
O-TOLUALDEHYDE	8	0.29	0.38	-0.002	-0.2	11	0.41	0.53	-0.003	-0.2	0.40	-0.2
M/P-TOLUALDEHYDE	54	2.03	2.62	-0.014	-1.1	43	1.60	2.07	-0.011	-0.9	1.67	-0.9
HEXANALDEHYDE	10	0.37	0.48	0.018	1.4	9	0.35	0.45	0.017	1.3	0.35	1.3
DIMETHYLBENZALDEHYDE	7	0.26	0.34	-0.002	-0.1	6	0.22	0.29	-0.002	-0.1	0.23	-0.1
SUMMED SPECIATED VALUES	2052	78	100	5	399	2064	77	100	5	396	77	396

A - 2,2-Dimethylpentane and methylcyclopentane co-elute. GC peak area split equally between the two compounds.
B - 3-Methyl-3-ethy-pentane co-elutes with reported compound. Not reported separately.
C - Cis-1,4-Dimethylcyclohexane co-elutes with reported compound. Not reported separately.
D - Propylcyclopentane co-elutes with reported compound. Not reported separately.
E - 2,5-Dimethylheptane and 3,5-dimethylheptane co-elute. GC peak area split equally between the two compounds.
F - Decane and isobutylbenzene co-elute. GC peak area split equally between the two compounds.
G - n-Butylbenzene co-elutes with reported compound. Not reported separately.
H - Isobutyraldehyde and methyl ethyl ketone co-elute. LC peak area split equally between the two compounds.

BAG CART VALUES												
HC	6038	228				6207	233				232	
CO	23810	901				20313	761				781	
CO2	14992000	567234				14814000	555247				556960	
NOX	129201	4888				121814	4566				4612	

APPENDIX D

PAH AND nPAH DATA

APPENDIX TABLE D-1. PAH AND nPAH DATA

Compound	B100-1										
	Mass, ng					Corrected Brake-Specific Mass, ng/hp-hr				Fractions	
	Filter			PUF		Filter					
	Cold	Hot	Bkgrd	Sample	Bkgrd	Cold	Hot	PUF	Composite	Filter	PUF
Benzo(a)anthracene	26703	24910	308	29111	2763	1104	1020	156	1187	87%	13%
Chrysene	3977	5095	639	52764	9107	140	185	258	436	41%	59%
Benzo(b)fluoranthene	4829	5095	186	30930	377	194	203	180	383	53%	47%
Benzo(k)fluoranthene	4261	4529	163	23653	204	171	181	138	318	56%	44%
Benzo(a)pyrene	2585	3397	1046	17467	53	64	97	103	196	47%	53%
Indeno(1,2,3-cd)pyrene	2358	2519	93	12372	nd	95	101	73	173	58%	42%
Dibenz(a,h)anthracene	682	736	nd	3093	nd	29	31	18.3	48	62%	38%
Benzo(g,h,i)perylene	3125	3680	122	11099	188	126	147	64	209	69%	31%
2-Nitrofluorene	224	153	5.8	176	1131	9.1	6.1	0.0	6.5	100%	0%
1-Nitropyrene	193	153	7.6	18	24	7.8	6.0	0.0	6.3	100%	0%
7-Nitrobenz(a)anthracene	4.0	3.4	nd	25	nd	trace	trace	trace	trace	n/a	n/a
6-Nitrochrysene	2.6	7.1	nd	14	nd	trace	trace	trace	trace	n/a	n/a
6-Nitrobenz(a)pyrene	nd	nd	nd	nd	nd	nd	nd	nd	nd	n/a	n/a

Compound	B100-2										
	Mass, ng					Corrected Brake-Specific Mass, ng/hp-hr				Fractions	
	Filter			PUF		Filter					
	Cold	Hot	Bkgrd	Sample	Bkgrd	Cold	Hot	PUF	Composite	Filter	PUF
Benzo(a)anthracene	39323	17907	308	62728	2764	1637	729	354	1212	71%	29%
Chrysene	6957	3087	639	116162	9107	265	101	632	757	16%	84%
Benzo(b)fluoranthene	10587	2686	186	48788	377	436	104	286	437	35%	65%
Benzo(k)fluoranthene	9679	2902	163	39495	204	399	113	232	386	40%	60%
Benzo(a)pyrene	5747	1914	1046	32525	53	197	36	192	250	23%	77%
Indeno(1,2,3-cd)pyrene	4537	1451	93	22303	nd	186	56	132	206	36%	64%
Dibenz(a,h)anthracene	1301	432	nd	5343	nd	55	18	32	55	42%	58%
Benzo(g,h,i)perylene	6050	2038	122	16727	188	249	79	98	201	51%	49%
2-Nitrofluorene	200	213	5.8	207	1131	8.1	8.6	0.0	8.5	100%	0%
1-Nitropyrene	163	114	7.6	15	24	6.5	4.4	0.0	4.7	100%	0%
7-Nitrobenz(a)anthracene	10	nd	nd	16	nd	trace	nd	trace	trace	n/a	n/a
6-Nitrochrysene	12	nd	nd	12	nd	0.5	nd	trace	trace	n/a	n/a
6-Nitrobenz(a)pyrene	nd	nd	nd	17	nd	nd	nd	trace	trace	n/a	n/a

APPENDIX TABLE D-1 (CONT'D). PAH AND nPAH DATA

Compound	B100-3										
	Mass, ng					Corrected Brake-Specific Mass, ng/hp-hr				Fractions	
	Filter			PUF		Filter		PUF	Composite		
	Cold	Hot	Bkgrd	Sample	Bkgrd	Cold	Hot			Filter	PUF
Benzo(a)anthracene	76893	46547	308	32490	2764	3196	1910	175	2267	92%	8%
Chrysene	12611	5586	639	62660	9107	500	204	315	561	44%	56%
Benzo(b)fluoranthene	15686	7448	186	27849	377	647	300	162	511	68%	32%
Benzo(k)fluoranthene	14456	6517	163	23207	204	597	262	135	445	70%	30%
Benzo(e)pyrene	11380	3724	1046	15549	53	431	111	91	247	63%	37%
Indeno(1,2,3-cd)pyrene	8304	3724	93	9747	nd	343	150	57	235	76%	24%
Dibenz(a,h)anthracene	2768	1303	nd	3249	nd	116	54	19.1	82	77%	23%
Benzo(g,h,i)perylene	11380	5275	122	8587	188	470	213	49	299	83%	17%
2-Nitrofluorene	197	341	5.8	225	1131	8.0	14	0.0	13	100%	0%
1-Nitropyrene	157	164	7.6	23	24.5	6.2	6.5	0.0	6.4	100%	0%
7-Nitrobenz(a)anthracene	1.5	1.8	nd	nd	nd	trace	trace	nd	trace	n/a	n/a
6-Nitrochrysene	nd	3.4	nd	nd	nd	nd	trace	nd	trace	n/a	n/a
6-Nitrobenz(a)pyrene	nd	nd	nd	nd	nd	nd	nd	nd	nd	n/a	n/a

Compound	2D-1										
	Mass, ng					Corrected Brake-Specific Mass, ng/hp-hr				Fractions	
	Filter			PUF		Filter		PUF	Composite		
	Cold	Hot	Bkgrd	Sample	Bkgrd	Cold	Hot			Filter	PUF
Benzo(a)anthracene	72407	91386	308	5029	2763	2738	3398	12.1	3318	99.6%	0.4%
Chrysene	85572	109663	639	7396	9106	3226	4068	0.0	3950	100.0%	0.0%
Benzo(b)fluoranthene	32912	40210	186	4142	377	1243	1493	20.0	1478	98.6%	1.4%
Benzo(k)fluoranthene	42786	54832	163	4142	204	1619	2040	20.9	2002	99.0%	1.0%
Benzo(e)pyrene	36204	40210	1046	3846	53	1335	1461	20.2	1464	98.6%	1.4%
Indeno(1,2,3-cd)pyrene	19747	23760	93	3550	nd	746	883	18.9	883	97.9%	2.1%
Dibenz(a,h)anthracene	6582	8042	nd	3254	nd	250	300	17.3	310	94%	6%
Benzo(g,h,i)perylene	28305	33996	122	2958	188	1070	1264	14.7	1251	98.8%	1.2%
2-Nitrofluorene	1679	1937	5.8	12425	1130	64	72	60	131	54%	46%
1-Nitropyrene	2238	1535	7.6	414	24	85	57	2.1	63	97%	3%
7-Nitrobenz(a)anthracene	32	31	nd	260	nd	1.2	1.1	1.4	2.5	45%	55%
6-Nitrochrysene	18	8.8	nd	41	nd	0.7	trace	trace	0.6	n/a	n/a
6-Nitrobenz(a)pyrene	56	31	nd	414	nd	2.1	1.2	2.2	3.5	37%	63%

APPENDIX TABLE D-1 (CONT'D). PAH AND nPAH DATA

Compound	2D-2										
	Mass, ng					Corrected Brake-Specific Mass, ng/hp-hr				Fractions	
	Filter			PUF		Filter		PUF	Composite	Filter	PUF
	Cold	Hot	Bkgrd	Sample	Bkgrd	Cold	Hot				
Benzo(a)anthracene	134619	108814	308	4390	2763	5051	4038	11.9	4193	99.7%	0.3%
Chrysene	161543	128598	639	6805	9107	6051	4762	12.4	4956	99.8%	0.2%
Benzo(b)fluoranthene	69233	52758	186	3732	377	2597	1957	12.9	2060	99.4%	0.6%
Benzo(k)fluoranthene	76925	56056	163	3732	204	2887	2080	13.8	2207	99.4%	0.6%
Benzo(a)pyrene	61540	49461	1046	3073	53	2275	1802	0.0	1868	100.0%	0.0%
Indeno(1,2,3-cd)pyrene	33462	31655	93	2195	nd	1255	1175	8.2	1194	99.3%	0.7%
Dibenz(a,h)anthracene	11154	10222	nd	2195	nd	419	380	11.7	398	97%	3%
Benzo(g,h,i)perylene	46155	42866	122	1910	188	1731	1591	5.6	1616	99.7%	0.3%
2-Nitrofluorene	2269	1385	5.8	9439	1131	85	51	50	106	53%	47%
1-Nitropyrene	4616	1847	7.6	285	24	173	68	1.2	84	98.5%	1.5%
7-Nitrobenz(a)anthracene	42	32	nd	21	nd	1.6	1.2	trace	1.4	n/a	n/a
6-Nitrochrysene	25	20	nd	nd	nd	0.9	0.7	nd	0.8	n/a	n/a
6-Nitrobenz(a)pyrene	46	46	nd	154	nd	1.7	1.7	trace	2.5	n/a	n/a

Compound	2D-3										
	Mass, ng					Corrected Brake-Specific Mass, ng/hp-hr				Fractions	
	Filter			PUF		Filter		PUF	Composite	Filter	PUF
	Cold	Hot	Bkgrd	Sample	Bkgrd	Cold	Hot				
Benzo(a)anthracene	87391	60458	308	5903	2763	3295	2254	16.7	2418	99.3%	0.7%
Chrysene	110920	77251	639	8627	9107	4173	2872	0.0	3055	100.0%	0.0%
Benzo(b)fluoranthene	50418	33588	186	1748	377	1901	1252	7.3	1351	99.5%	0.5%
Benzo(k)fluoranthene	47057	29557	163	2497	204	1774	1102	12.2	1209	99.0%	1.0%
Benzo(a)pyrene	40334	24519	1046	1430	53	1487	880	7.3	973	99.2%	0.8%
Indeno(1,2,3-cd)pyrene	26217	16458	93	1022	nd	988	613	5.4	672	99.2%	0.8%
Dibenz(a,h)anthracene	8739	5710	nd	976	nd	331	214	5.2	236	97.8%	2.2%
Benzo(g,h,i)perylene	36973	21496	122	1067	188	1394	801	4.7	889	99.5%	0.5%
2-Nitrofluorene	2286	1545	5.8	14529	1130	86	58	71.4	133	46.4%	53.6%
1-Nitropyrene	7731	1679	7.6	704	24	292	63	3.6	99	96%	4%
7-Nitrobenz(a)anthracene	77	34	nd	54	nd	2.9	1.3	trace	1.8	n/a	n/a
6-Nitrochrysene	44	17	nd	32	nd	1.7	0.6	trace	0.9	n/a	n/a
6-Nitrobenz(a)pyrene	37	40	nd	nd	nd	1.4	1.5	nd	1.5	n/a	n/a

Exhibit 7

Biodiesel Tier II: 90 Day Sub-Chronic Inhalation Study of Exhaust Emissions as Required Under Section 211(b) of the Clean Air Act

Organizing entity:

National Biodiesel Board
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The following companies are participating groups with the biodiesel data submittal to fulfill Tier 2 requirements of 40 CFR Part 79 for biodiesel as a fuel and fuel additive finalized by the Environmental Protection Agency:

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Peter Cremer North America
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Biodiesel Development Corporation
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Marathon, FL 33050

West Central Cooperative
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Ralson, IA 51459

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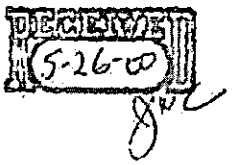

Executive Summary

This document is to satisfy the Tier 2 requirements for the registration of biodiesel as a fuel and fuel additive (F/FA) under section 211(b) of the Clean Air Act (CAA). The Tier 1 requirements were previously submitted to EPA by NBB. The Tier 2 work conducted was performed in accordance with the specifications described in the Code of Federal Regulations requirements for fuel and fuel additives registration, 40 CFR Part 79 and its subsequent amendments.

Tier 2 – 90 Day Sub-Chronic Inhalation Study of Biodiesel Exhaust Emissions

The National Biodiesel Board (NBB) contracted with the Lovelace Respiratory Research Institute (LRRI) of Albuquerque, New Mexico to complete a 90 day sub-chronic inhalation study of biodiesel exhaust with specific health assessments for general systemic toxicity, carcinogenicity/mutagenicity, reproductive toxicity, teratology, and neurotoxicity.

Since the biodiesel group is the only fuel or fuel additive to undertake new testing as outlined in 40 CFR part 79 to comply with Tier 2, NBB and LRRI worked cooperatively with EPA to ensure the protocols used met the regulations outlined under the Tier 2 requirements in 40 CFR part 79. To this end, copies of the protocol were forwarded to EPA for staff level review prior to execution of the work (see attached letter from EPA dated April 24, 1998).

Included in this submission is a complete copy of the *Final Report, Tier 2 Testing of Biodiesel Exhaust Emissions*, LRRI report number FY98-056 dated May 22, 2000, provided to NBB by LRRI. The report consists of a 59 page bound document summarizing in detail the methods and results of the work. Additional supplemental data, including the experimental protocol, protocol amendments, and protocol and SOP deviations, are in Appendices contained in two (2) three-ring binders included in this submission (one containing appendices A - K, one containing appendices L - T) as well as in the archived Study File kept at LRRI.

The testing summarized below and contained in the Final Report and its appendices fully meets the requirements outlined by the Environmental Protection Agency in 40 CFR part 79 as amended. No additional testing is needed to meet the Tier 2 requirements of Section 211(b) of the Clean Air Act.

Tier 2 Biodiesel Exhaust Exposure Results

The study design imposed by EPA in 40 CFR part 79 stipulates three groups of rats be exposed to differing levels of exhaust concentrations—one overtly toxic, one with an intermediate level of toxicity, and one minimally toxic or non-toxic. In the LRRI study, F344 rats were exposed to diluted biodiesel exhaust emissions at targeted NOx concentrations of 5, 25, or 50 ppm, while other rats served as air-exposed controls. The high level concentration was set to achieve the maximum possible exhaust concentration

without forcing a water condensation condition in the housing cages and while remaining within the temperature constraints required.

Based upon the Tier 1 speciation data from biodiesel fueled engines that showed substantial reductions in particulate matter and other toxic exhaust emissions, LRRI expressed concern that the maximum achievable concentration using biodiesel exhaust may not produce any adverse affects. If this was the case, it could be possible that EPA would consider the study invalid. This was discussed with EPA during the protocol development and it was agreed that the study would provide the information required by Tier 2 even if the study produced no adverse affects at the high concentration level. The medium and low level exposures were set at 50% and 10% of the maximum achievable concentration. Actual exposure concentrations achieved were within acceptable ranges.

The fuel used for the testing was 100% biodiesel (B100) as required by EPA. The biodiesel used for the testing was produced from soybean oil and met the requirements set forth by ASTM PS 121, the American Society for Testing and Materials (ASTM) specification for biodiesel, as outlined in the protocol. The engines used to generate the exhaust were two new 1998 model Cummins B5.9 L6 turbo diesel engines connected to eddy current dynamometers. The dynamometers were operated using repeated EPA Heavy-Duty Engine Dynamometer Schedule (EDS) cycles without the motoring periods of the EDS cycle as allowed by 40 CFR part 86. Each engine was operated for a 125-hour break-in period on B100 prior to the beginning of exposures.

No pronounced toxicity resulted from the subchronic exposure of rats to biodiesel exhaust emissions at any concentration. Neither mortality nor abnormal clinical observations were attributed to exposure to biodiesel exhaust. Similarly, there were no adverse ocular responses due to biodiesel exposure, nor was feed consumption affected by exposure. Serological samples from rats before and after the study demonstrated that the animals were free from infections by common rodent pathogens. During two days of the study (study days 29 and 68), the body weights of high-level exposure female, but not male, rats were less than body weights of control female rats. Although statistically significant, the decrease was minor, was not observed at other timepoints, and therefore was not judged by LRRI to be a toxic response to exposure.

Groups of rats in the Special Histology Group were free from any histologic evidence of neurotoxicity, and the ability of LRRI's neurohistopathology techniques was demonstrated by identifying neurotoxic responses or rats treated with acrylamide.

Rats in the General Histology Group of the study were examined for both organ weights and histopathology. Relative to total body weights, the lungs of female rats in the high-level group weighed more than lungs from control group females. In addition, minimal to mild dark gray mottling of the surface of the lungs was observed at gross necropsy with increasing exposure levels. According to LRRI, these responses are probably related to lung histology findings described below.

In addition, other non-pulmonary organ weight differences were observed. These included lower absolute liver weights for both male and female rats in the high-level

FINAL REPORT

TIER 2 TESTING OF BIODIESEL EXHAUST EMISSIONS

Study Report Number FY98-056

Submitted to:

National Biodiesel Board (NBB)

1907 Williams Street - P.O. Box 104898

Jefferson City, Missouri 65110

Submitted by:

Lovelace Respiratory Research Institute (LRRI)

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May 22, 2000

Total numbers of pages 1005

the data shown in Table 7 reflects correction made to keep daily averages within the required range.

Table 7. Summary of NO_x concentration data (ppm).[a]

	Control	Low Level	Intermediate Level	High Level
NO_x	1 ± <1	5 ± 1	26 ± 3	51 ± 5
NO	NQ[b]	5 ± 1	25 ± 3	49 ± 4
NO_2	1 ± 4	1 ± <1	1 ± <1	2 ± 1

[a]Values are mean plus or minus one standard deviation.
[b]Analyzer reading was below value that could be quantified.

2. *Gas Analyte Measurements*

CO, CO_2, SO_2, and hydrocarbon average concentrations for the three levels are summarized in Table 8. SO_2 and hydrocarbon readings were not taken during the first 14 exposure days because the analyzers were not available. Daily values are detailed in Appendix F.

Table 8. Summary of particulate and gas analyte concentration data.[a]

	Control	Low Level	Intermediate Level	High Level
CO, ppm	0.5 ± 0.5	2.2 ± 1.2	15.2 ± 4.8	36.8 ± 10.2
CO_2, % vol.	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.3 ± 0.1
SO_2, ppm	0.0 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.3 ± 0.1
Hydrocarbon, ppm	0.1 ± 0.2	0.1 ± 0.2	0.3 ± 1.4	0.5 ± 1.0
O_2, %	20.6 ± 0.2	20.5 ± 0.1	20.0 ± 0.2	19.3 ± 0.4
Particulate, mg/m^3	A. 0.017 ± 0.022[b]	0.04 ± 0.03	0.2 ± 0.1	0.5 ± 0.1
	B. 0.017 ± 0.022	0.1 ± 0.2	0.5 ± 1.8	1.1 ± 4.3

[a]Values are mean plus or minus one standard deviation.
[b]A. is the particulate concentration excluding the days when the fuel filter was plugged. B. is the particulate concentration with all days indicated. See text for more explanation.

Exhibit 8

NEXT Biodiesel Tips 1

FUEL AND FUEL ADDITIVE REGISTRATION TESTING FOR NEXTFUELS, INC.

FINAL REPORT

SwRI® Project No. 03.11947

Prepared for:

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Results and discussion given in this report relate only to the test items described in this report.

IDENTIFICATION OF TEST SUBSTANCE

Palm Oil Methyl Ester

MANUFACTURER

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TEST SUBSTANCE INFORMATION

The Nextfuels, Inc. additive technology is a Palm Oil Methyl Ester (PME) which is obtained from typical Malaysian and Indonesia sources of palm oil (Elias guineensis) and converted to fatty acid methyl esters (FAME) through the classical transesterification reaction to produce a mixture of FAME with a composition of:

Chemical Name	Carbon Number	Double Bonds	Composition, appox. %
Lauric	12	0	0.2
Myristic	14	0	1.1
Palmitic	16	0	44.0
Stearic	18	0	4.5
Oleic	18	1	39.2
Linoleic	18	2	10.1
Others	--[a]	--	0.9

[a]Various

PME has been accepted for use as a heating oil/power turbine fuel and as an on-road diesel in the European Union (EU) under EN 14213/14214 and has been tested and used in Malaysia as blends up to 5 percent in diesel fuel. The high degree of saturation and the low proportion of linoleic acid results in a FAME with high oxidative stability with a relatively high pour point of about 10°C. High pour points limit the used of PME blends in winter and in cold regions. While these limitations are present, the overall energy balance of producing PME is positive and better than rape seed or soybean oil. The Material Safety Data Sheet (MSDS) for PME is included in Appendix C.

5.0 TEST RESULTS

Emissions testing was performed with a 2006 6.0 L DIT Navistar A345C heavy-duty diesel engine. This engine was operated on a base fuel and on the base fuel blended with 20 percent Palm Oil Methyl Ester. Tests were performed with the base fuel after 125 hours of engine operation and with the base fuel containing the Palm Oil Methyl Ester after 125 hours of engine operation. Six cold- and eighteen hot-start tests were conducted to characterize emissions from each of the fuels. Three sets of one cold- and six hot-start test sequences were conducted with the exhaust aftertreatment in place, and three sets were performed with the aftertreatment removed.

5.1 Regulated Emissions

The 2006 emissions standards limit the sum of the NO_x and NMHC (NMHC+NO_x) to 2.4 g/bhp-hr or to 2.5 g/bhp-hr if the non-methane hydrocarbons do not exceed 0.5 g/bhp-hr. After 125 hours of engine operation with the base fuel, the average composite emissions were equivalent to corresponding 2006 emission standards with aftertreatment (2.5 g/bhp-hr) and were slightly higher without aftertreatment (2.7 g/bhp-hr). In this case, the average composite emissions were 2.4 g/bhp-hr for NO_x and 0.12 g/bhp-hr for NMHC with aftertreatment and 2.5 g/bhp-hr for NO_x and 0.21 g/bhp-hr for NMHC without aftertreatment. Particulate emissions exceeded the 0.10 g/bhp-hr standard both with and without aftertreatment (0.13 and 0.15 g/bhp-hr, respectively). These results were not unexpected as the base fuel contained almost 500 ppm sulfur and 38 percent aromatics. Both the aromatic and the sulfur concentrations were higher for the base fuel than for fuels typically used in certification testing. Fuels with higher aromatic content are often associated with higher NO_x and particulate emissions. The CO emissions met the 2006 standards with the base fuel both with and without aftertreatment. When the aftertreatment was disabled, the THC, CO, and particulate increased as expected.

After 125 hours of engine operation, tests with base fuel blended with Palm Oil Methyl Ester and the aftertreatment gave NMHC+NO_x and particulate emissions that were equivalent to the 2006 emission standards (2.5 g/bhp-hr for NMHC+NO_x and 0.10 g/bhp-hr for particulate). These results were similar to the baseline emissions except that the particulate was about 30 percent lower. Without aftertreatment, the NMHC+NO_x and particulate were higher. When the aftertreatment was removed, the NMHC emissions were 45 percent higher while there was no change in the CO, and particulate emissions increased by 0.01 g/bhp-hr. Table 6 summarizes the regulated emissions at each test condition. Appendix A contains the individual and composite emission test results.

5.2 Speciation of Volatile Hydrocarbon Compounds

Speciation of the volatile hydrocarbon compounds with carbon numbers from C_1 to C_{12} plus aldehydes, ketones, and three ethers (methyl tertiary butyl ether - MTBE, ethyl tertiary butyl ether - ETBE, and di-isopropyl ether - DIPE) was performed for the first cold- and hot-segment of the EPA transient cycle. More than 200 compounds were checked for their presence in the dilute exhaust. Data for the individual compounds, corrected for background dilution air contributions, are included in Appendix B.

Exhibit 9

Figure 1 presents annual estimates of the components of total FAME biodiesel feedstock volumes over 2011 through 2023. The estimates show a stable pattern of feedstock usage, with soybean oil the largest source of FAME biodiesel feedstock in each year. Soybean oil usage peaked in 2020 at 8.6 billion pounds, and then fell back to 7.3 billion pounds in 2023. In most years, the next two largest feedstocks were corn oil and yellow grease. The biggest change for 2023 was growth in the volume of canola oil, which increased by over 400 million pounds. This was undoubtedly spurred by the late 2022 approval of canola oil pathways under the Renewable Fuel Standard (RFS) by the U.S. Environmental Protection Agency (EPA) (Voegele, 2022). The gain in canola oil volume mainly came at the expense of corn oil.

Figure 1. Composition of Feedstock Usage for Annual Production of U.S. FAME Biodiesel by Volume and Major Feedstock Type, 2011 - 2023

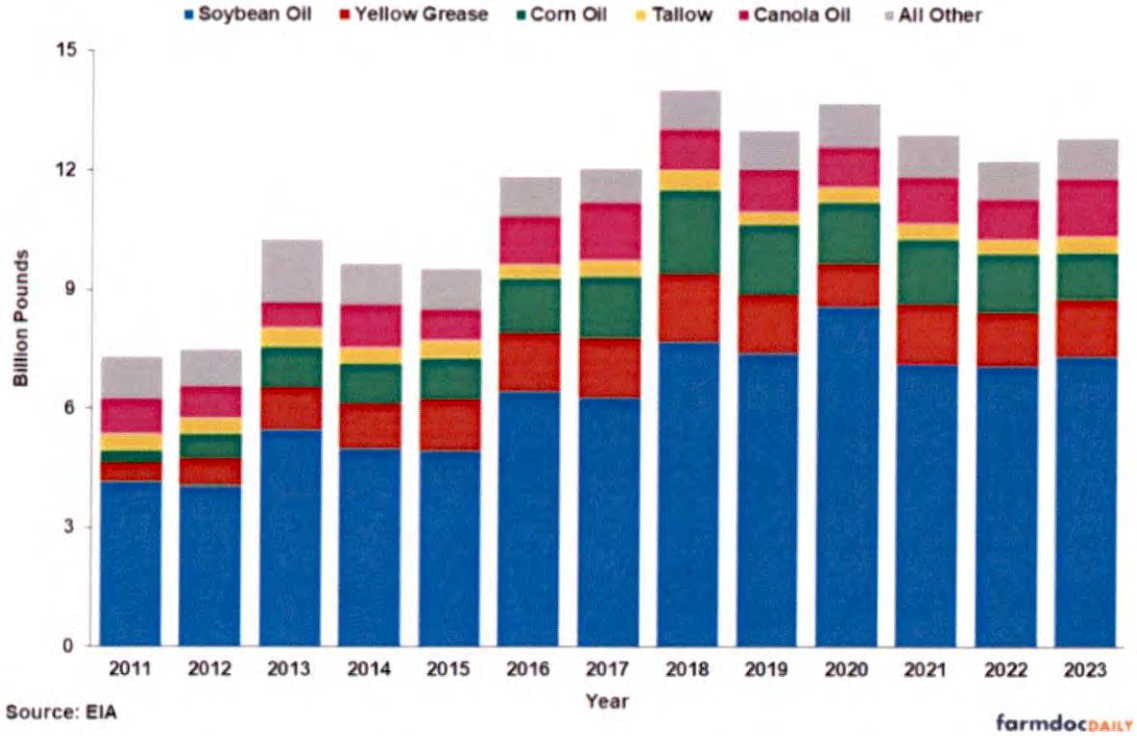

Figure 2 presents the allocation of feedstock usage in percentage terms to provide direct evidence on annual market shares. In every year over 2011 through 2023, soybean oil represented a majority of biodiesel feedstock usage, with an average share of 55.4 percent. The next largest category was corn oil, with an average of 11.1 percent. In general, percentage feedstock shares for biodiesel have been stable over time.

Figure 2. Composition of Feedstock Usage for Annual Production of U.S.