ExxonMobil BIOMEDICAL SCIENCES, INC.

CONTRACT NUMBER: 2005-101815

FINAL REPORT

STUDY NUMBER: 0545979

TEST SUBSTANCE: MRD-05-459

READY BIODEGRADABILITY: OECD 301F MANOMETRIC RESPIROMETRY TEST on HIGH NAPHTHENIC, HEAVY, STRAIGHT-RUN NAPHTHA

PERFORMED FOR:
American Petroleum Institute
1220 L Street, NW
Washington, DC 20005-4070

PERFORMED AT:
ExxonMobil Biomedical Sciences, Inc.
Laboratory Operations
1545 Route 22 East, P.O. Box 971
Annandale, New Jersey 08801-0971

STUDY COMPLETION DATE: March 1, 2007

08TP 11

Revision 1: November 18, 2008

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GLP COMPLIANCE STATEMENT

I hereby accept responsibility for the validity of these data and declare that to the best of my knowledge the study contained herein was performed under my supervision in compliance with the OECD[1] and USEPA[2] Good Laboratory Practice (GLP) standards with exceptions noted below.

The test substance elemental analysis may not have been performed in a GLP compliant manner, since Quantitative Technologies Inc. (QTI) is not a GLP compliant facility. However, a standard, (Acetanilide), was employed to monitor the quality of the data. The values were within the standard limits. QTI is a FDA and DEA-registered contract Analytical Research & Development Laboratory, operating in accordance with cGMP regulations.

Contaminant analysis of the water was not performed in a GLP compliant manner. Accutest® laboratory is accredited by the National Environmental Laboratory Accreditation Conference (NELAC). The analyses are performed using standard US EPA methods.

Both QTI and Accutest® have been audited by ExxonMobil Biomedical Sciences, Inc. using the ExxonMobil Quality Practices and Guidelines (QP & G v. 5.1).

It is unknown if the positive control substance (sodium benzoate) identity and stability analysis was performed in a GLP compliant manner. The substance is supplied by Sigma Aldrich, an internationally recognized chemical supply company.

None of the above exceptions are believed to have an adverse effect on the study results.

[redacted]

1 Mar 07
Date

ExxonMobil Biomedical Sciences, Inc.
1545 Route 22 East, P.O. Box 971
Annandale, New Jersey 08801-0971

[redacted]

1 MAR 07
Date

The final report was accepted by the Sponsor.

[redacted]

2/12/2007
Date

QUALITY ASSURANCE STATEMENT

STUDY NUMBER: 0545979

TEST SUBSTANCE: MRD-05-459

STUDY SPONSOR: American Petroleum Institute

Listed below are the inspections performed by the Quality Assurance Unit of ExxonMobil Biomedical Sciences, Inc., the date(s) of inspection, and the date(s) findings were reported to the Study Director and Management.

Study Phase Inspected	Date(s) of Inspection	Reported to Study Director	Reported to Management
Protocol	10,11 Oct 05	11 Oct 05	13 Oct 05
Protocol Revision 1	13 Dec 05	13 Dec 05	15,16 Dec 05
Term pH	19 Jan 06	20 Jan 06	23,24 Jan 06
Final Report	07,09,16 Mar 06, 17,22 Mar 06	22 Mar 06	20 Jun 06
Second Review of Final Report	13,15 Jun 06	15 Jun 06	20 Jun 06
Report Revision 1	22 Jan 08	22 Jan 08	23 Jan 08

The final report accurately reflects the methods, procedures and observations documented in the raw data.

[redacted]

25 Nov '08
Date

Revision 1: November 18, 2008

PERSONNEL

Study Director:	[redacted]
Sponsor Representative:	[redacted]
Laboratory Coordinator:	[redacted]
Quality Assurance Unit Coordinator:	[redacted]
Environmental Toxicology & Fate Lead Investigator:	[redacted]

SUMMARY

The biodegradability potential of the test substance, MRD-05-459 (High Naphthenic, Heavy, Straight-Run Naphtha), a positive control substance (sodium benzoate) and a toxicity control (combination of test substance and positive control) was studied in aerobic, aqueous test systems. This study was performed in general agreement with the procedure outlined in the OECD 301F[3] guideline. Biodegradability of the substance was determined by measuring oxygen consumption in a test medium containing trace nutrients and inoculated with activated sludge supernatant. The test substance, High Naphthenic, Heavy, Straight-Run Naphtha, was evaluated at a mean concentration of 49.2 mg/L. The positive control substance, sodium benzoate, was evaluated at a concentration of 50.4 mg/L. The toxicity control was evaluated at mean concentration of 98.6 mg/L.

The average percent biodegradation of triplicate test systems of High Naphthenic, Heavy, Straight-Run Naphtha was determined to be 77% over a 28 day testing period at a temperature range of 22 ± 2°C. The OECD guideline criteria for classification of a chemical as readily biodegradable states: 1) percent biodegradation must reach 60% within 28 days, and 2) the 60% degradation must be attained within 10 days of exceeding 10% biodegradation. High Naphthenic, Heavy, Straight-Run Naphtha exceeded 10% biodegradation on Day 4 and attained 60% biodegradation on Day 12. Based on test results, High Naphthenic, Heavy, Straight-Run Naphtha can be considered readily biodegradable.

The guideline states that a test substance will be considered inhibitory if the toxicity test systems, containing both the test and positive control substance, reach less than 25% biodegradation by Day 14. The toxicity control systems exceeded 25% by Day 2 therefore the test substance cannot be considered inhibitory at the test concentration.

The OECD guideline validity requirement states that the difference of extreme values should be less than 20% by Day 28, the positive control should exceed 60% of the ThOD by Day 14, and the oxygen uptake of the blank on Day 28 should not exceed 60 mg/L. Sodium benzoate exceeded 60% of the ThOD by Day 2 and the mean cumulative oxygen consumed in the blank systems on Day 28 was 15.51 mg/L. The test substance difference of extremes was 3.8%. Therefore, based on the study data and the passing of other validity requirements, this test is considered valid.

The table below summarizes Day 28 percent biodegradation results for the positive control, test substance and toxicity control.

Test System	Replicate #	% Biodegradation	Mean (SD)	Final pH
Sodium Benzoate	1 2 3	93.26 98.61 96.43	96.10 (2.69)	7.2 7.2 7.2
MRD-05-459 (High Naphthenic, Heavy, Straight-Run Naphtha)	1 2 3	75.20 78.13 77.81	77.05 (1.61)	6.9 6.7 6.7
Toxicity Control	1 2 3	88.40 84.30 84.54	85.75 (2.30)	7. 1 7.1 7.1

INTRODUCTION

Objective

This study was conducted for the sponsor in order to evaluate the potential of the test substance to biodegrade in an aerobic, aqueous environment for use in environmental hazard assessment.

Sponsor

American Petroleum Institute
1220 L Street, NW
Washington, DC 20005-4070

Testing Facility

ExxonMobil Biomedical Sciences, Inc.
Laboratory Operations
1545 Route 22 East, P.O.Box 971
Annandale, New Jersey 08801-0971

Study Initiation Date

December 7, 2005

Experimental Start

December 22, 2005

Experimental Completion

January 19, 2006

INTRODUCTION (CONT'D)

Compliance

The study was conducted in compliance with OECD[1] and USEPA[2] Good Laboratory Practice (GLP) standards with the exception outlined on pages 9 and 10.

This study was performed in general agreement with the OECD[3] guideline with the exceptions listed on page 13.

Justification for Selection of Test System

Selection of the aerobic aquatic biodegradation test is based upon the OECD 301F[3] guideline. This test method is used to determine ready biodegradability by measuring oxygen consumption in a test system consisting of an activated sludge supernatant, test or positive control substance and a nutrient source. Further, activated sludge has historically been used to evaluate the persistence of chemicals in the environment.

Justification of Dosing Route

The test substance could possibly be found in aqueous solution in a wastewater treatment facility.

MATERIALS AND METHODS

Test Substance Identification

EMBSI Identification:	MRD-05-459
Sponsor Identification:	High Naphthenic, Heavy, Straight-Run Naphtha*
Supplier:	EPL Archives, Inc. Sterling, VA
Date Received:	September 30, 2005
Expiration Date:	September, 2010
Description:	Colorless liquid

Storage Condition: The neat test substance was stored at room temperature.

Characterization of Test Substance

The neat test substance was characterized and the stability determined by the testing facility using the following analysis: UltraViolet/Visible and Infrared Spectrophotometry, Gas Chromatography with Mass Selective Detection and Density. Characterization of the test substance was performed at the testing facility prior to its use and after completion of this study. Documentation of characterization and stability assessment is maintained at the testing facility (see Appendix C).

Documentation outlining the methods of synthesis, fabrication, and/or derivation of the test substance are maintained by the sponsor. The test substance, as received, was considered the "pure" substance.

Elemental Analysis (subcontracted)

Quantitative Technologies Inc. (QTI) (Elemental Analysis Only)
P.O. Box 470
Salem Industrial Park, Bldg 5
Whitehouse, New Jersey 08888

An aliquot of the test substance was sent to Quantitative Technologies Inc. (QTI) for elemental analysis, specifically carbon, hydrogen, nitrogen and oxygen. Percent carbon, hydrogen, nitrogen, and oxygen were determined using a Perkin-Elmer 2400 CHN Elemental Analyzer equipped with an oxygen accessory kit. For CHN, the analyzer used combustion to convert the sample elements to simple gases. Upon entering the analyzer, the sample was combusted in a pure oxygen environment. The product gases were separated under steady state conditions, and measured as a function of thermal conductivity. For oxygen, pyrolysis was used to convert the oxygen to carbon monoxide which was separated from the other pyrolozates under steady state conditions and measured as a function of thermal conductivity. This documentation can be found in the raw data and Appendix D.

* An explanation of the Chemical Abstract Service (CAS) number designation for this test sample is provided in Appendix H.

MATERIALS AND METHODS (CONT'D)

Sample Retention

A non-study specific sample of the neat test substance has been retained in the testing facility archives.

Positive Control Substance

Substance Identification:	Sodium Benzoate, 99%
Manufacturer:	Aldrich Chemical Company, Lot No. 09519HA

Storage Condition: The neat substance was stored at room temperature.

Characterization: The documentation of the stability, identity, solubility, purity, strength, and composition or other characteristics, which appropriately identify the positive control substance, was provided by the manufacturer. This documentation is identified as the Certificate of Analysis sheet and can be found in the raw data and Appendix E.

Carrier

Glass distilled water (gdH_2O) was used as the carrier. The glass distilled water is prepared from UV sterilized deionized well water that is treated and distributed throughout the testing facility via PVC and stainless steel pipes. The feed water for the deionized water system is analyzed by Accutest®, 2235 Route 130, Dayton, New Jersey 08810. Results of the water analyses are maintained at the testing facility. There are no known contaminants in the water believed to be present at levels that may have interfered with this study.

Inoculum

Fresh activated sludge was used as the inoculum. The activated sludge was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, New Jersey on December 21, 2005. This treatment facility was selected because it deals predominantly with domestic sewage as specified in the guideline. There were no known contaminants in the fresh activated sludge believed to be present at levels high enough to have interfered with this study. A complete description of the inoculum preparation is provided in Appendix A.

MATERIALS AND METHODS (CONT'D)

Solutions

Mineral salt solutions:

Phosphate buffer - pH 7.2 (VWR, Lot# 5129)
Ferric chloride - 0.025% (VWR, Lot# 4180)
Magnesium sulfate - 2.25% (VWR, Lot# 4131)
Calcium chloride - 2.75% (VWR, Lot# 4180)

There were no known contaminants in the solutions believed to be present at levels that may have interfered with the study. All solutions were refrigerated when not in use.

Test medium: The test medium was prepared one day before the test began. A total of 20 liters of glass distilled water was collected in a carboy. The glass distilled water in the carboy was then amended with mineral salt solutions and inoculum. A complete description of the test medium preparation is provided in Appendix A.

Positive control substance stock solution: A stock solution of sodium benzoate at a concentration of approximately 10,000 mg/L was prepared in glass distilled water. An O.I. Analytical Model 1010 Total Organic Carbon (TOC) Analyzer determined the actual carbon content of the sodium benzoate stock solution. The instrument employs a wet oxidation technique with a nondispersive infrared (NDIR) detector. TOC results are contained in Appendix B. The stock solution was refrigerated when not in use.

Test System

The test system was considered as one or any combination of the following in a flask (specific preparation in Appendix A):

Test or Positive Control Substance
Toxicity Control (combination of Test and Positive Control Substance)
Test Medium (containing the following):
Mineral Salt Solutions
Activated Sludge Supernatant
Glass Distilled Water

All test containers used in this study were uniquely identified as to appropriate composition, i.e., Blank -1, 2, 3; MRD-05-459 - 1, 2, 3, etc. All glassware was washed with Chem-Solv® and then rinsed with glass distilled water to remove any residual organic carbon. All glassware was inspected to ensure cleanliness. The manometric cells were rinsed with two portions of acetone, filled with soapy water and allowed to stand for a few hours. The cells were then rinsed with glass distilled water followed by acetone then finally air dried.

EXPERIMENTAL PROCEDURE

Procedure Summary

The test procedure evaluated the ready biodegradability of the test and positive control substance and a combination of the two (toxicity control) by microorganisms in water. The consumption of oxygen was determined by measuring the quantity of oxygen (produced electrolytically) required to maintain constant gas volume in the respirometer flask, or from the change in volume or pressure (or a combination of the two) in the apparatus. Evolved carbon dioxide was absorbed in a solution of 10N sodium hydroxide (NaOH). The amount of oxygen taken up by the microbial population during biodegradation of the test or positive control substance (corrected for uptake by blank inoculum, run in parallel) is expressed as a percentage of theoretical oxygen demand (ThOD). The ThOD calculation is found in Appendix B. The test was performed in general agreement with the OECD 301F[3] guideline with the following clarifications/exceptions:

Clarification

1. The apparatus is an electrolytic respirometer, manufactured by Co-ordinated Environmental Service, Ltd. (Kent, England). The system is based on a proven oxygen generating process coupled to a sensitive manometric cell. The sample was placed in a sample flask, which was then sealed by a manometric cell/CO_2 trap and immersed in a temperature stabilized water bath. For the duration of the experiment, the sample was stirred by a magnetically coupled stirrer. As the biodegradation process progressed, the microorganisms consumed O_2 converting it to CO_2 during aerobic respiration. The CO_2 produced was absorbed by a solution of 10N NaOH in the CO_2 trap, which caused a net reduction in gas pressure within the sample flask. This pressure reduction was detected by the manometric cell and triggered the electrolytic process. The electrolytic process generated oxygen, which restored the pressure in the sample flask. The magnitude and duration of the electrolyzing current are proportional to the amount of oxygen supplied to the microorganisms.

EXPERIMENTAL PROCEDURE (CONT'D)

Clarification (Cont'd)

2. The test and positive control substances were tested at concentrations of approximately 50 mg/L. Sodium benzoate was administered to the respective test systems as an aliquot of an aqueous stock solution. The toxicity control (a combination of positive control and test substance) was tested at a concentration of approximately 99 mg/L. The test substance was injected directly into the test flasks containing test medium with a syringe. The weight difference of the syringe was recorded as the weight of test substance added to the flask. Each flask was sealed immediately after addition of the test substance to avoid loss due to volatilization. No aqueous stock solutions were prepared for the test substance because of its poor solubility in water. Also no concentration verification was performed since the test substance is poorly soluble in water.

3. The positive control, test substance and toxicity control test systems were tested in triplicate.

4. Bias was minimized by preparing the test medium on a large volume basis. In addition, the test medium was aerated for approximately 24 hours to improve homogeneity and ensure random distribution of test organisms to all test systems. The pH of the test medium was 7.3. The initial pH of individual systems was not determined due to the poor solubility of the test substance in water.

5. Dissolved organic carbon (DOC) analysis was not performed due to the poor solubility of the test substance.

Exceptions

1. No abiotic sterile control systems were tested.

2. Test medium was prepared on a large volume basis, aerated and aliquoted into each test container, instead of preparation in the individual test systems.

3. The commercial phosphate buffer, used in preparation of the test medium, has a pH value of 7.2 rather than 7.4. The phosphate buffer, purchased from VWR, has been approved by the American Public Health Association (APHA) for use in the Biological Oxygen Demand (BOD) analysis. The BOD buffer has the same composition as the buffer stated the OECD 301F[3].

4. The inoculum was mixed for 2 minutes in a blender at low speed, instead of medium speed.

RESULTS AND DISCUSSION

Testing was conducted to assess the biodegradability potential of the test substance, High Naphthenic, Heavy, Straight-Run Naphtha, in triplicate test systems at an average concentration of 49.2 mg/L. The biodegradation of the positive control substance, sodium benzoate and a toxicity control (combination of test substance and positive control) were also measured in triplicate test systems at average concentrations of 50.4 mg/L and 98.6 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in duplicate. This study was conducted at a temperature range of 22 ± 2°C for twenty eight days in general agreement with the OECD 301F[3] guideline.

The percent biodegradation results and mg oxygen consumed for each test system are reported in Tables 1 and 2, respectively. The oxygen consumed by the test systems was corrected for oxygen consumption occurring in the blank test systems. The Day 28 mean percent biodegradation for High Naphthenic, Heavy, Straight-Run Naphtha was determined to be 77.05%.

The guideline states that a test substance will be considered inhibitory if the toxicity test systems, containing both the test and positive control substance, reach less than 25% biodegradation by Day 14. The toxicity control systems exceeded 25% by Day 2; therefore, the test substance cannot be considered inhibitory at the test concentration.

This test is considered valid since it met the OECD guideline validity requirements as follows: 1) sodium benzoate biodegraded to >60% of the ThOD by Day 2 and 2) the average of the cumulative oxygen consumed in the blank systems was 15.51 mg/L. 3) test substance difference of extremes was 3.8%. A graphical illustration representing the mean percent biodegradation and the mg oxygen consumed by the test systems is reported in Figures 1 and 2, respectively.

The inoculum was prepared using activated sludge from the Clinton Sanitary Wastewater Treatment Plant, Annandale, New Jersey. The Easicult® TTC dip slide results indicated an average bacterial population of 10^5 colony forming units (CFU)/mL. Biodegradation results for the test and positive control substances were calculated as the net amount of oxygen (mg) consumed by the test system multiplied by a constant. The net amount of oxygen was calculated as the difference between the test system oxygen consumption (mg) and the average oxygen (mg) consumed by the blanks. The amount of oxygen consumed was recorded at each hourly interval for each test system using the CES aerobic respirometer. The constant is defined as the inverse of the product of the ThOD and the mg of the test or positive control substance added to that system multiplied by 100. The ThOD was calculated based on the empirical formula of the appropriate substance. The actual amount of substance added to each system is reported in Appendix A. The ThOD and methods used to determine percent biodegradation are described in Appendix B. The mean percent biodegradation and ThOD calculations were written in Microsoft Excel®.

CONCLUSION

The mean percent biodegradation of triplicate test systems of High Naphthenic, Heavy, Straight-Run Naphtha was determined to be 77% over a 28 day testing period. The test substance achieved 60% biodegradation within the 10 days of exceeding 10% biodegradation; therefore, the test substance can be considered readily biodegradable.

PROTOCOL DEVIATIONS

Temperature deviations were noted for the respirometer baths during the study. Maximum deviations of approximately 1°C above the protocol required 22±1°C occurred, for approximately two days. This is not believed to have had an impact on the integrity or results of the study.

RECORDS

All appropriate materials, methods and experimental measurements required by the protocol have been recorded and documented in the raw data. Any changes, additions or revisions to the protocol were approved by the Study Director and the Sponsor Representative. These changes have been documented in writing, including the date, the justification for the change and the signatures of the Study Director and Sponsor Representative.

The protocol, final report, raw data or computer-generated listings of raw data, supporting study documentation and a non-study specific neat test substance sample will be maintained in the archives of the testing facility for 10 years, after which time the records will be offered to the sponsor prior to disposal.

REFERENCES

1. Organization for Economic Cooperation and Development, (OECD), Principles of Good Laboratory Practice, C(97) 186/Final, 1997.

2. United States Environmental Protection Agency, (USEPA), Toxic Substances Control Act (TSCA), Good Laboratory Practice Standards, 40 CFR Part 792, 1989.

3. Organization for Economic Cooperation and Development, Guidelines for the Testing of Chemicals, Ready Biodegradability, 301F Manometric Respirometry Test (1992).

TABLE 1

PERCENT BIODEGRADATION RESULTS

Test	SODIUM BENZOATE					MRD-05-459					Toxicity Control				
Day	Rep 1	Rep 2	Rep 3	**Mean**	**SD**	Rep 1	Rep 2	Rep 3	**Mean**	**SD**	Rep 1	Rep 2	Rep 3	**Mean**	**SD**
1	29.99	32.77	31.60	**31.45**	**1.40**	0.34	0.50	0.37	**0.40**	**0.09**	11.98	6.00	11.53	**9.84**	**3.33**
2	60.90	65.41	61.07	**62.46**	**2.56**	0.57	1.11	0.82	**0.83**	**0.27**	25.31	25.03	25.58	**25.31**	**0.28**
3	73.46	78.19	74.28	**75.31**	**2.53**	8.02	9.18	9.42	**8.87**	**0.75**	29.43	29.12	29.66	**29.40**	**0.27**
4	80.42	84.97	80.57	**81.99**	**2.58**	16.10	17.11	16.62	**16.61**	**0.51**	35.00	34.31	34.97	**34.76**	**0.39**
5	83.98	89.14	84.11	**85.74**	**2.94**	21.84	23.04	22.42	**22.43**	**0.60**	38.65	38.40	38.64	**38.56**	**0.14**
6	86.40	91.50	86.92	**88.27**	**2.81**	26.58	28.15	27.38	**27.37**	**0.79**	43.23	43.18	43.21	**43.21**	**0.03**
7	89.62	94.62	90.66	**91.63**	**2.64**	33.36	35.74	34.68	**34.59**	**1.19**	47.46	47.55	47.24	**47.42**	**0.16**
8	95.31	100.44	98.09	**97.95**	**2.57**	43.64	43.75	44.13	**43.84**	**0.26**	50.82	50.47	50.44	**50.58**	**0.21**
11	102.73	108.58	103.05	**104.79**	**3.29**	58.18	61.23	59.03	**59.48**	**1.57**	61.26	57.28	61.46	**60.00**	**2.36**
12	102.51	108.11	103.08	**104.57**	**3.08**	63.12	67.44	65.58	**65.38**	**2.17**	64.97	61.19	65.82	**63.99**	**2.46**
13	101.80	107.15	102.62	**103.86**	**2.88**	67.65	69.86	69.07	**68.86**	**1.12**	69.74	64.43	69.02	**67.73**	**2.88**
14	101.11	106.19	104.08	**103.79**	**2.55**	72.54	71.62	71.32	**71.83**	**0.64**	74.36	67.88	74.36	**72.20**	**3.74**
15	98.62	103.20	101.87	**101.23**	**2.36**	72.98	72.25	71.46	**72.23**	**0.76**	76.38	69.06	76.69	**74.04**	**4.32**
16	96.74	101.59	100.50	**99.61**	**2.54**	73.17	73.31	71.57	**72.68**	**0.97**	77.64	70.47	77.71	**75.27**	**4.16**
17	95.23	100.33	99.49	**98.35**	**2.73**	72.83	73.65	71.57	**72.68**	**1.05**	78.75	71.87	78.06	**76.23**	**3.79**
18	94.45	100.29	98.96	**97.90**	**3.06**	72.73	73.95	71.84	**72.84**	**1.06**	80.20	73.37	78.49	**77.35**	**3.55**
19	94.11	100.01	97.83	**97.32**	**2.98**	72.60	74.30	72.16	**73.02**	**1.13**	81.17	74.54	79.06	**78.26**	**3.39**
20	94.13	99.48	97.30	**96.97**	**2.69**	72.77	74.96	72.94	**73.56**	**1.22**	82.16	75.49	79.76	**79.14**	**3.38**
21	93.40	98.75	96.57	**96.24**	**2.69**	72.76	75.39	73.56	**73.90**	**1.35**	82.92	76.06	80.32	**79.77**	**3.46**
22	93.26	98.61	96.43	**96.10**	**2.69**	73.02	76.21	74.54	**74.59**	**1.60**	83.78	76.80	81.06	**80.55**	**3.52**
23	93.26	98.61	96.43	**96.10**	**2.69**	73.24	77.54	75.55	**75.44**	**2.15**	84.44	77.77	81.94	**81.38**	**3.37**
24	93.26	98.61	96.43	**96.10**	**2.69**	73.57	77.83	76.39	**75.93**	**2.17**	85.23	79.62	82.74	**82.53**	**2.81**
25	93.26	98.61	96.43	**96.10**	**2.69**	73.89	78.13	76.91	**76.31**	**2.18**	85.97	81.71	83.26	**83.65**	**2.16**
26	93.26	98.61	96.43	**96.10**	**2.69**	73.89	78.13	77.09	**76.37**	**2.21**	86.72	82.84	83.52	**84.36**	**2.07**
27	93.26	98.61	96.43	**96.10**	**2.69**	74.11	78.13	77.26	**76.50**	**2.12**	87.65	83.40	83.86	**84.97**	**2.33**
28	93.26	98.61	96.43	**96.10**	**2.69**	75.20	78.13	77.81	**77.05**	**1.61**	88.40	84.30	84.54	**85.75**	**2.30**

The Day 9 and Day 10 data reports were not generated due to a computer malfunction.

The sodium benzoate biodegradation exceeded 100% between Day 9 (estimated) and Day 15; this was due to a lag in oxygen consumption by the Blank systems. This is not believed to have had an impact on the results of the study.

Difference of extremes= (Sodium Benzoate) $\frac{(98.61)-(93.26)}{95.94} \times 100 = 5.6\%$

Difference of extremes= (MRD-05-459) $\frac{(78.13)-(75.20)}{76.67} \times 100 = 3.8\%$

Difference of extremes= (Toxicity Control) $\frac{(88.40)-(84.30)}{86.35} \times 100 = 4.7\%$

Difference of extremes = ((highest replicate value - lowest replicate value) / mean of high and low values) x 100

TABLE 2

MG OXYGEN CONSUMED RESULTS

Test	BLANK					SODIUM BENZOATE				
Day	Rep 1	Rep 2*	Rep 3	**Mean**	**SD**	Rep 1	Rep	2 ep	3	**Mean**	**SD**
1	0.00	XXX	0.00	**0.00**	**0.00**	25.22	27.55	26.57		**26.45**	**1.17**
2	0.00	XXX	0.00	**0.00**	**0.00**	51.21	55.00	51.35		**52.52**	**2.15**
3	0.00	XXX	0.00	**0.00**	**0.00**	61.77	65.74	62.45		**63.32**	**2.12**
4	0.00	XXX	0.00	**0.00**	**0.00**	67.62	71.45	67.74		**68.94**	**2.18**
5	0.58	XXX	0.58	**0.58**	**0.00**	71.20	75.53	71.30		**72.68**	**2.47**
6	1.23	XXX	1.08	**1.16**	**0.11**	73.80	78.09	74.24		**75.38**	**2.36**
7	1.23	XXX	1.08	**1.16**	**0.11**	76.51	80.72	77.39		**78.21**	**2.22**
8	1.23	XXX	1.08	**1.16**	**0.11**	81.30	85.61	83.63		**83.51**	**2.16**
11	3.12	XXX	3.37	**3.25**	**0.18**	89.63	94.55	89.90		**91.36**	**2.77**
12	3.94	XXX	4.23	**4.09**	**0.21**	90.28	94.98	90.76		**92.01**	**2.59**
13	5.16	XXX	5.02	**5.09**	**0.10**	90.69	95.19	91.38		**92.42**	**2.42**
14	6.66	XXX	5.56	**6.11**	**0.78**	91.13	95.40	93.63		**93.39**	**2.15**
15	9.83	XXX	7.41	**8.62**	**1.71**	91.55	95.40	94.27		**93.74**	**1.98**
16	12.35	XXX	8.43	**10.39**	**2.77**	91.73	95.82	94.90		**94.15**	**2.15**
17	14.43	XXX	9.73	**12.08**	**3.32**	92.15	96.44	95.73		**94.77**	**2.30**
18	15.93	XXX	10.83	**13.38**	**3.61**	92.80	97.71	96.59		**95.70**	**2.57**
19	16.97	XXX	11.68	**14.33**	**3.74**	93.46	98.42	96.59		**96.16**	**2.51**
20	17.51	XXX	12.04	**14.78**	**3.87**	93.92	98.42	96.59		**96.31**	**2.26**
21	18.08	XXX	12.70	**15.39**	**3.80**	93.92	98.42	96.59		**96.31**	**2.26**
22	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**
23	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**
24	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**
25	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**
26	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**
27	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**
28	18.31	XXX	12.70	**15.51**	**3.97**	93.92	98.42	96.59		**96.31**	**2.26**

* Replicate 2 was not included in the study; following cell initialization excessive oxygen consumption was observed (>10 mg), this may have been due to a possible breach or respirometer malfunction.

Test	MRD-05-459					Toxicity Control				
Day	Rep 1	Rep 2	Rep 3	**Mean**	**SD**	Rep 1	Rep 2	Rep 3	**Mean**	**SD**
1	0.58	0.83	0.62	**0.68**	**0.13**	28.22	13.95	27.22	**23.13**	**7.97**
2	0.96	1.85	1.37	**1.39**	**0.45**	59.60	58.23	60.37	**59.40**	**1.08**
3	13.60	15.37	15.70	**14.89**	**1.13**	69.31	67.74	69.99	**69.01**	**1.15**
4	27.28	28.66	27.72	**27.89**	**0.70**	82.43	79.82	82.53	**81.59**	**1.54**
5	37.59	39.15	37.96	**38.23**	**0.82**	91.61	89.92	91.75	**91.09**	**1.02**
6	46.21	48.29	46.81	**47.10**	**1.07**	102.96	101.61	103.13	**102.57**	**0.83**
7	57.69	61.00	58.98	**59.22**	**1.67**	112.91	111.79	112.64	**112.45**	**0.58**
8	75.12	74.41	74.74	**74.76**	**0.36**	120.85	118.58	120.18	**119.87**	**1.17**
11	101.86	105.77	101.69	**103.11**	**2.31**	147.52	136.51	148.27	**144.10**	**6.58**
12	111.06	116.99	113.43	**113.83**	**2.98**	157.08	146.44	159.39	**154.30**	**6.91**
13	119.74	122.06	120.26	**120.69**	**1.22**	169.33	154.98	167.97	**164.09**	**7.92**
14	129.05	126.03	125.03	**126.70**	**2.09**	181.22	164.04	181.59	**175.62**	**10.03**
15	132.30	129.59	127.78	**129.89**	**2.27**	188.51	169.29	189.59	**182.46**	**11.42**
16	134.40	133.13	129.74	**132.42**	**2.41**	193.24	174.35	193.78	**187.12**	**11.07**
17	135.51	135.38	131.43	**134.11**	**2.32**	197.53	179.28	196.28	**191.03**	**10.19**
18	136.63	137.20	133.18	**135.67**	**2.18**	202.25	184.07	198.59	**194.97**	**9.62**
19	137.36	138.74	134.65	**136.92**	**2.08**	205.48	187.74	200.90	**198.04**	**9.21**
20	138.11	140.28	136.40	**138.26**	**1.94**	208.27	190.40	203.00	**200.56**	**9.18**
21	138.69	141.61	138.05	**139.45**	**1.90**	210.67	192.34	204.92	**202.64**	**9.37**
22	139.26	143.11	139.80	**140.72**	**2.08**	212.81	194.17	206.79	**204.59**	**9.51**
23	139.63	145.34	141.49	**142.15**	**2.91**	214.35	196.42	208.87	**206.55**	**9.19**
24	140.19	145.82	142.88	**142.96**	**2.82**	216.23	200.73	210.75	**209.24**	**7.86**
25	140.74	146.32	143.76	**143.61**	**2.79**	217.98	205.61	211.98	**211.86**	**6.19**
26	140.74	146.32	144.05	**143.70**	**2.81**	219.72	208.23	212.58	**213.51**	**5.80**
27	141.11	146.32	144.34	**143.92**	**2.63**	221.91	209.54	213.39	**214.95**	**6.33**
28	142.94	146.32	145.25	**144.84**	**1.73**	223.68	211.62	215.00	**216.77**	**6.22**

The Day 9 and Day 10 data reports were not generated due to a computer malfunction.

FIGURE 1

PERCENT BIODEGRADATION

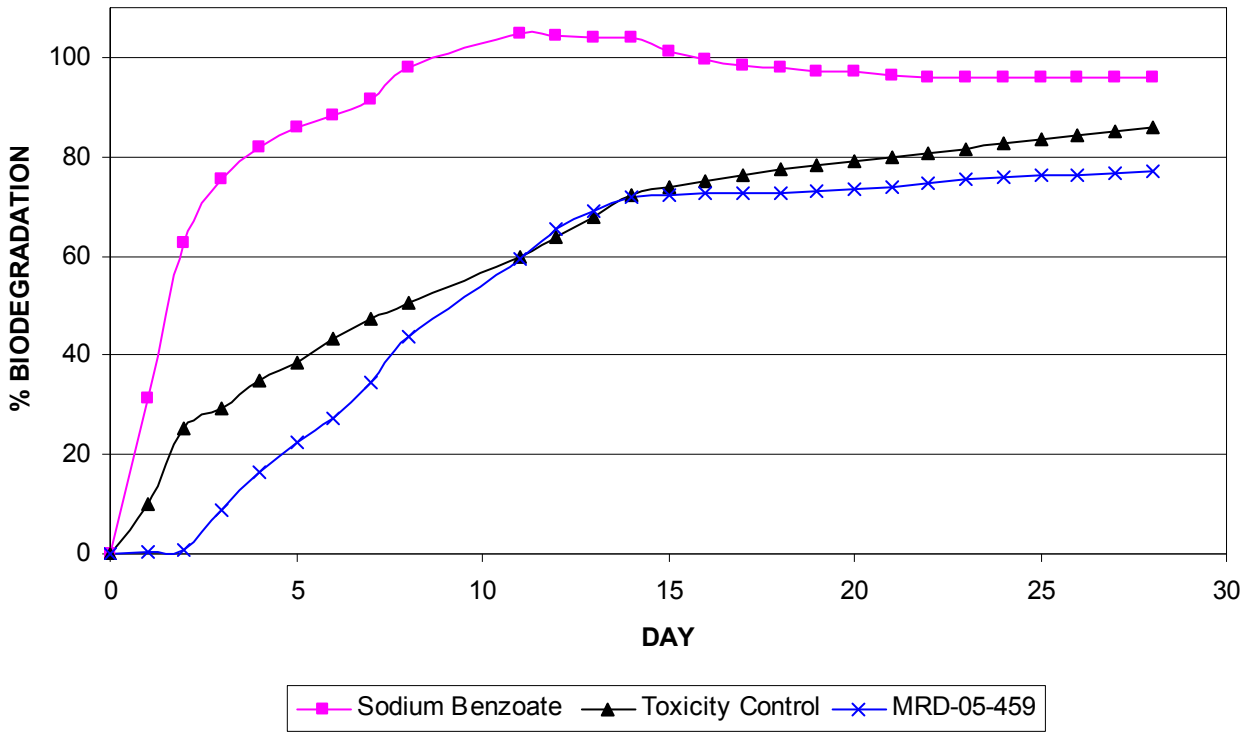
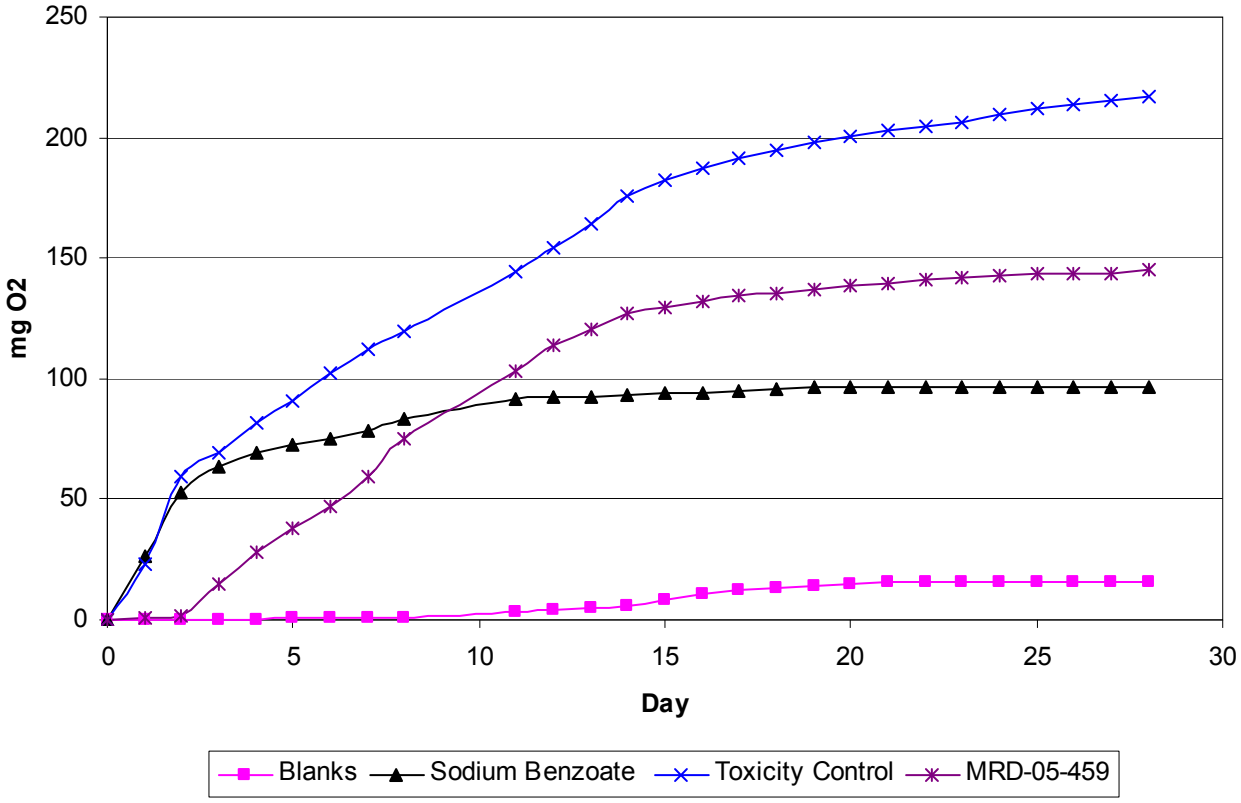


FIGURE 2

MG OXYGEN CONSUMED



APPENDIX A - MANOMETRIC RESPIROMETRY TEST PROCEDURE

Inoculum Preparation

Fresh activated sludge was obtained on Day -1 of the test from the Clinton Sanitary Wastewater Treatment Plant in Annandale, NJ. Duplicate 10 mL aliquots of the activated sludge were filtered through pre-weighed Whatman 934-AH filter pads in a Buchner funnel and vacuum flask set up. The filter pads were placed in an aluminum pan and dried in an oven for one hour and twelve minutes at 101°C. After cooling, the filters were reweighed and the mean total suspended solids concentration was determined to be 3.5 g/L. The sludge was homogenized in a blender for two minutes at low speed. The homogenated sample was allowed to settle for one hour and fifteen minutes, after which the supernatant was decanted (avoiding carry-over of sludge solids). An aliquot of the supernatant was used to determine microbial activity. The microbial activity was determined using the Easicult®-TTC dip slides Lot No. 1793201. This was accomplished by removing the agar stick from the culturing tube, and dipping the agar into the supernatant aliquot. Excess supernatant was blotted off with a clean paper towel, and the agar stick was then placed back into the culture tube. The whole unit was placed into a dark upright incubator for 48 hours at 20 ± 1°C monitored by the Watchdog V5 monitoring system. Based on comparison of the density of colonies growing on the agar with the model density chart provided by the supplier, the microbial activity was determined to be 10^5 CFU/mL. The remaining decanted sludge supernatant was used for final preparation of the test medium on Day -1.

Test Medium Preparation

Twenty liters of glass distilled water were collected in a carboy. A quantity of 460 mL of glass distilled water was removed from the carboy to obtain a final volume of twenty liters after addition of the mineral salt solutions and activated sludge supernatant. The following quantities of mineral salt solutions and inoculum were added to the carboy:

1 mL of magnesium sulfate solution per liter of glass distilled water
1 mL of calcium chloride solution per liter of glass distilled water
10 mL of phosphate buffer solution per liter of glass distilled water
1 mL of ferric chloride solution per liter of glass distilled water
10 mL of activated sludge supernatant per liter of glass distilled water

The test medium was aerated with carbon dioxide free air for 24 hours before use.

APPENDIX A - MANOMETRIC RESPIROMETRY TEST PROCEDURE (CONT'D)

Preparation of the Test Systems

Test systems were prepared as follows:

Test System 1L Respirometer Flask		Amount of Neat Test Substance MRD-05-459 Added (mg)	Amount of 10069 mg/L Sodium Benzoate Stock Solution Added (mL)	Test Medium (Liter)
Blank	Rep 1	---	---	1.0
	Rep 2*	---	---	1.0
	Rep 3	---	---	1.0
Sodium Benzoate	Rep 1	---	5.0	1.0
	Rep 2	---	5.0	1.0
	Rep 3	---	5.0	1.0
MRD-05-459 (High Naphthenic, Heavy, Straight-Run Naphtha)	Rep 1	48.9	---	1.0
	Rep 2	49.1	---	1.0
	Rep 3	49.7	---	1.0
Toxicity Control	Rep 1	48.8	5.0	1.0
	Rep 2	47.4	5.0	1.0
	Rep 3	48.6	5.0	1.0

* Replicate 2 of the Blank system was not used, excessive oxygen consumption was observed on Day 0, therefore, data collection was not initiated.

The test substance test systems were dosed by weighing a syringe containing the test substance, injecting the test substance into a test flask containing one liter of test medium and reweighing the syringe. The weight difference is equal to the amount of test substance added to the test systems. Each test system was sealed immediately after addition of the test substance to minimize loss due to volatilization. The sodium benzoate systems were dosed by adding 5.0 mL of 10069 mg/L stock solution to the respective test systems. After assembly of the test systems, stirring was initiated, the equipment was checked to ensure no leaks were present, and the oxygen uptake measurements were initiated. No further attention was required other than printing the respirometer data and making daily checks during normal working hours to see that the correct temperature (22 ± 1°C) and adequate stirring were maintained. At the end of 28 days, the pH of the contents in each flask was measured using a Hanna® pH checker.

APPENDIX B - CALCULATIONS

Theoretical Oxygen Demand (ThOD)

The empirical formula and the theoretical oxygen demand (ThOD) of the test substance were calculated from elemental analysis data (assuming 100 gram test substance). Sodium benzoate ThOD was calculated using the empirical formula and was determined to be 1.67 mg O_2/mg sodium benzoate. The ThOD calculation of the test and positive control substance was based on Annex IV of OECD 301F[3] guideline.

TEST SUBSTANCE	% CARBON	% HYDROGEN	% OXYGEN	% NITROGEN	MOLE OF CARBON	MOLE OF HYDROGEN	MOLE OF OXYGEN	MOLE OF NITROGEN	MOLE OF SODIUM	MOL. WT.	ThOD
MRD-05-459	85.54	14.35	0.10	0.08	7.12	14.24	0.01	0.01	0.00	100.17	3.41
Sodium Benzoate					7.00	5.00	2.00	0.00	1.00	144.11	1.67
Sodium Benzoate & MRD-05-459					14.12	19.24	2.01	0.01	1.00	244.28	2.38

Elemental Analysis performed by QTI

MOLE = % ELEMENT (IN GRAMS)/ATOMIC WT OF ELEMENT)
AT. WT OF C = 12.011 G/MOLE
AT. WT OF H = 1.0079 G/MOLE
AT. WT OF O = 15.999 G/MOLE
AT. WT OF N = 14.007 G/MOLE

MOL. WT. = (MOLE OF CARBON x AT. WT.) + (MOLE OF HYDROGEN x AT. WT.) + (MOLE OF OXYGEN x AT. WT.) + (MOLE OF NITROGEN x AT. WT.) + (MOLE OF SODIUM x AT. WT.)

ThOD (mg O2/mg Test Substance) = [16 x ((2 x NO. OF CARBON) + ((0.5 x (NO. OF HYDROGEN) - (3 x NO. OF NITROGEN))) + (0.5 x SODIUM) - (NO. OF OXYGEN))]/MOL. WT.

* Sodium Benzoate = $C_7H_5O_2Na$

Molecular weight = 144.11

$$\text{THOD} = \frac{16 \times [(2 \times \text{moles of carbon}) + (0.5 \times \text{moles of Hydrogen}) + (0.5 \times \text{moles of Na}) - (\text{moles of Oxygen})]}{\text{Molecular weight}}$$

$$\text{Sodium Benzoate THOD} = \frac{16 \times [(2 \times 7) + (0.5 \times 5) + (0.5 \times 1) - 2]}{144.11} = 1.665394$$

Sodium Benzoate Concentration

The sodium benzoate stock solution concentration was determined to be 10069 mg sodium benzoate/L by dividing the solution total organic carbon (TOC) content (5840 mg carbon /L) by the percent carbon of sodium benzoate (58%). A 5 mL aliquot of the solution added to each test system contained 50.35 mg of sodium benzoate. The pH of the stock solution was 7.3.

Percent biodegradation values were calculated by the respirometer software. The following parameters for each system were entered into the software: the ThOD, and the mass of positive control or test substance added. The software incorporates the hourly logged oxygen uptake value along with the entered parameters into the following calculations to derive the percent biodegradation.

$$Constant = 100 \frac{1}{ThOD \times mg\ test\ substance\ in\ vessel}$$

$$\%\,Percent\ Biodegradation = (mg\ O_2\ uptake\ by\ test\ substance - \overline{X}\ mg\ O_2\ uptake\ by\ blank) \times constant$$

The mg of oxygen consumed by the blank represents the average oxygen consumption for the duplicate test systems.

APPENDIX C - TEST SUBSTANCE CHARACTERIZATION

The test substance was initially characterized on December 14, 2005. Analyses included Ultraviolet-Visible (UV-VIS) spectroscopy and Fourier Transform Infrared (FT-IR) spectroscopy, density and GC-MS analysis. Stability of the neat test substance was confirmed by repeating these same analyses on February 6, 2006 after the completion of this study.

UV-VIS spectra are presented in Figures C-1 and C-2 representing, the initial and final spectrum at concentrations of 1096 and 1670 ppm with methanol, respectively. UV-VIS spectra were acquired on a Hewlett-Packard 8453 diode array UV-VIS spectrophotometer using a 1 cm quartz cell, a scan time of 0.5 seconds, and resolution of 2 nm.

FT-IR spectra of the neat test substance are presented in Figures C-3 and C-4 representing the initial and final spectra. FT-IR spectra were acquired on a Thermo Nicolet Avatar 360 FT-IR spectrometer with a KBr plate. The spectra were obtained with the following settings: resolution of 4 cm^{-1}, gain of 1, and scan number of 32.

The test substance was also characterized by GC-MS using a Varian Saturn 2000 GC-MS system with a Varian 3800 gas chromatograph. For comparison of relative retention times to a series of known hydrocarbons under the analytical conditions employed, High Naphthenic, Heavy Straight-Run Naphtha was analyzed against an ASTM D3710 calibration mixture. Figures C-5 and C-6 represent the initial and final GC-MS total ion chromatograms, respectively. The test substance eluted as a complex mixture with numerous chromatographic components detected between retention times 4 and 20 minutes. This corresponds to bracketing by the standard hydrocarbons n-heptane and n-decane under the analytical conditions employed. The single most abundant component eluted at approximately 4.7 minutes.

The test substance initial and final density were measured at 20°C using an Anton Paar DMA 4500 Density/Specific gravity/Concentration meter. The initial density was measured as 0.7500 g/mL and the final density was 0.7504 g/mL. The test substance was observed to be a liquid under ambient laboratory conditions and immiscible in water but miscible in methanol and hexane.

Comparison of the initial and final analyses appeared to be substantially similar indicating the neat test substance was stable over the duration of the study period.

APPENDIX C - TEST SUBSTANCE CHARACTERIZATION (CONT'D)

UV-VIS SPECTRA

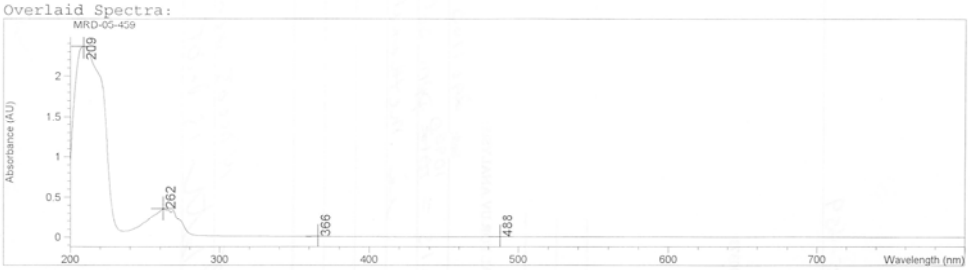
Figure C-1
Initial

Initial Characterization High Naphthenic, Heavy Straight-Run Naphtha
1096 ppm solution in methanol

Spectrum/Peak Report Date 12/14/05 Time 12:35:29 Page 1 of 1
Initial Characterization MRD-05-459 1096ppm solution with methanol

Method file : CHAR.M Last update: Date 06/14/02 Time 14:46:04
Information : Default Method
Data File : A:\05-459I.SD Created : 12/14/05 12:27:31

Overlaid Spectra:



#	Name	Peaks(nm)	Abs(AU)	#	Name	Peaks(nm)	Abs(AU)
1	MRD-05-459	209.0	2.3633	1		366.0	0.0097
1		262.0	0.3588	1		488.0	0.0048

Report generated by : RGM Signature: B. Kelly 14Dec05

*** End Spectrum/Peak Report ***

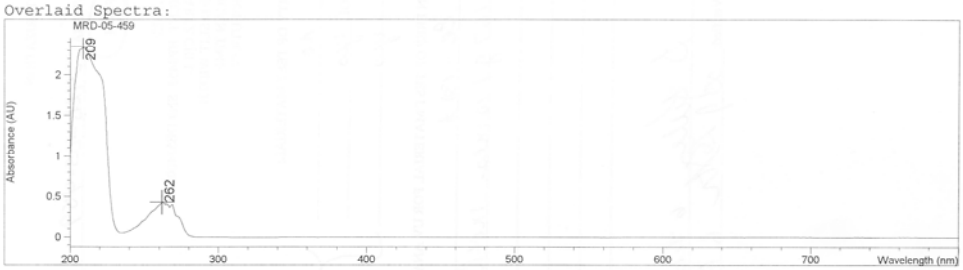
Figure C-2
Final

Final Characterization High Naphthenic, Heavy Straight-Run Naphtha
1670 ppm solution in methanol

Spectrum/Peak Report Date 02/06/06 Time 16:01:55 Page 1 of 1
Final Characterization MRD-05-459 1670 ppm solution with methanol

Method file : CHAR.M Last update: Date 12/23/05 Time 12:07:09
Information : Default Method
Data File : A:\05-459F.SD Created : 2/6/06 15:50:12

Overlaid Spectra:



#	Name	Peaks(nm)	Abs(AU)	#	Name	Peaks(nm)	Abs(AU)
1	MRD-05-459	209.0	2.3389	1		262.0	0.429

Report generated by : B. KELLEY Signature: B. Kelly 6Feb06

*** End Spectrum/Peak Report ***

APPENDIX C - TEST SUBSTANCE CHARACTERIZATION (CONT'D)

FT-IR SPECTRA
Figure C-3
Initial

Initial Characterization High Naphthenic, Heavy Straight-Run Naphtha

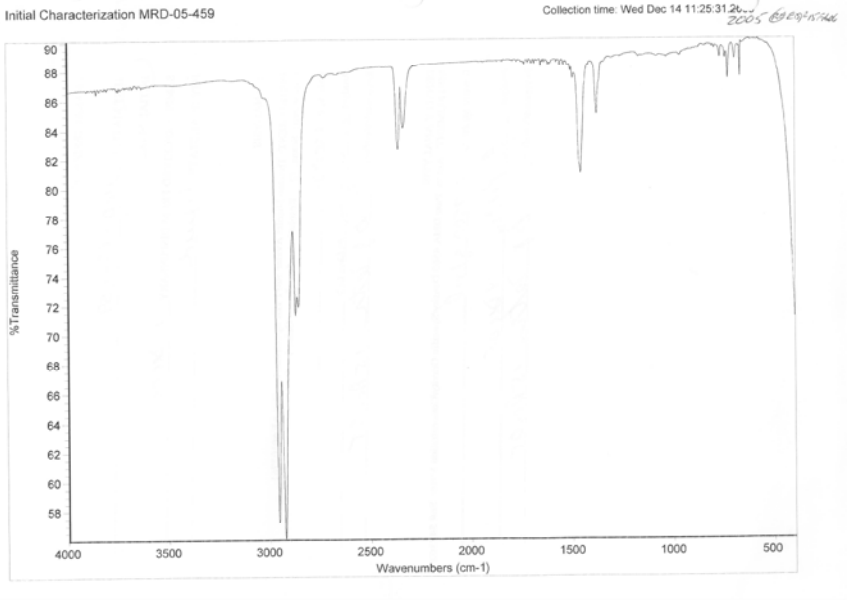
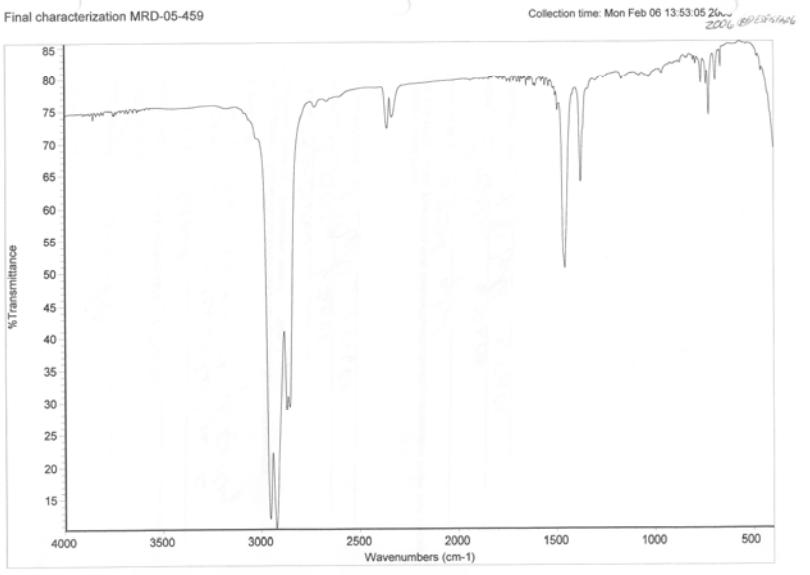


Figure C-4
Final

Final Characterization High Naphthenic, Heavy Straight-Run Naphtha

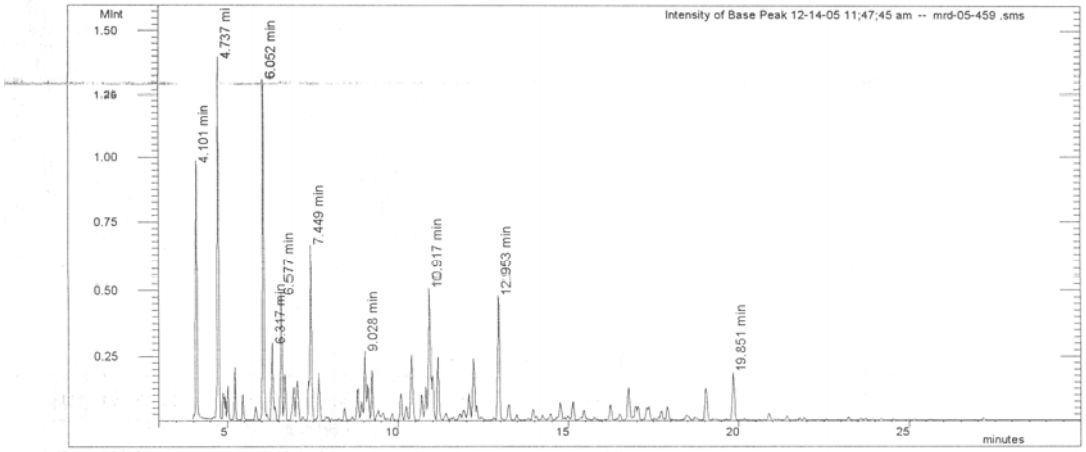


APPENDIX C - TEST SUBSTANCE CHARACTERIZATION (CONT'D)

INITIAL TOTAL ION CHROMATOGRAM
Figure C-5

AREA PERCENT REPORT

Data File Name:	c:\saturnws\12-14-05 11;47;45 am -- mrd-05-459 .sms	**Acquisition Date:**	12/14/05 11:47:46 AM
Inst. Method:	C:\SaturnWS\Volatiles Characterization.mth	**Instrument ID:**	Saturn GC/MS #1
Sample Name:	MRD-05-459	**Inj. Notes:**	MRD-05-459 (naphtha) initial characterization 0.1uL neat injection



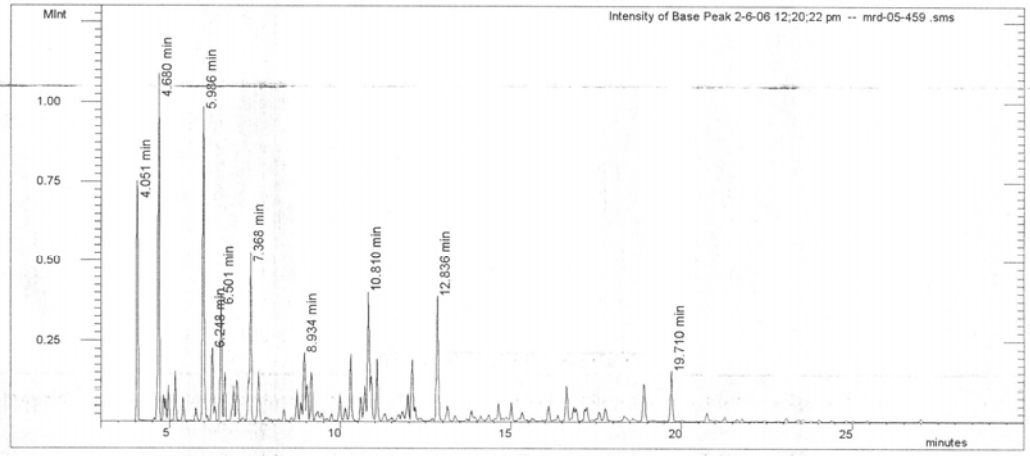
RT	BC	Width	Area	Area %
4.101	VB	2.0	12218080	13.54
4.737	VV	2.3	17090430	18.94
6.052	VV	2.9	16640670	18.45
6.317	VV	2.7	4815559	5.34
6.577	VV	2.8	5718792	6.34
7.449	VV	2.8	11889580	13.18
9.028	VV	3.3	3717686	4.12
10.917	VV	3.3	4873207	5.40
12.953	VV	1.7	8715346	9.66
19.851	VV	3.8	4536770	5.03

APPENDIX C- TEST SUBSTANCE CHARACTERIZATION (CONT'D)

FINAL TOTAL ION CHROMATOGRAM
Figure C-6

AREA PERCENT REPORT

Data File Name:	c:\saturnws\2-6-06 12;20;22 pm -- mrd-05-459 .sms	**Acquisition Date:**	2/6/06 12:20:23 PM
Inst. Method:	C:\SaturnWS\Volatiles Characterization.mth	**Instrument ID:**	Saturn GC/MS #1
Sample Name:	MRD-05-459	**Inj. Notes:**	MRD-05-459 (naphtha) final characterization 0.1uL neat injection



RT	BC	Width	Area	Area %
4.051	BV	2.2	9214827	12.62
4.680	VV	2.6	13481210	18.47
5.986	VV	3.1	12981490	17.78
6.248	VV	2.9	4449701	6.10
6.501	VV	3.0	4552902	6.24
7.368	VV	3.1	10703130	14.66
8.934	VV	3.4	3048895	4.18
10.810	VV	3.5	4069873	5.58
12.836	VV	3.6	7099908	9.73
19.710	VM	3.9	3397429	4.65

APPENDIX D – TEST SUBSTANCE, ELEMENTAL ANALYSIS

QUANTITATIVE TECHNOLOGIES INC.
P.O. Box 470, Salem Industrial Park, Bldg. 5
Whitehouse, NJ 08888
(908) 534-4445 FAX (908) 534-1054
www.QTIonline.com info@QTIonline.com

EXXONMOBILE BIOMEDICAL SCIS
1545 RTE 22 E
ANNANDALE NJ 08801

23-May-06

ANALYTICAL REPORT

Sample number	%C	%H	%N	%O
①ACETANILIDE	71.05	6.72	10.21	11.60
MRD 05-459	85.54	14.35	0.08	< 0.1

**Reissue of original reports dated 12/14/05 & 12/19/05 to combine results of both reports and remove the name in the address. Also, to correct the sample ID number.

① standard results accepted. ESF 15Jun06

/mk

QA Approved: [redacted]

Ebs_14

APPENDIX E - SODIUM BENZOATE CERTIFICATE OF ANALYSIS

SIGMA-ALDRICH

Certificate of Analysis

Product Name Sodium benzoate
Product Number 10,916-9
Product Brand ALDRICH
CAS Number 532-32-1
Molecular Formula $C_7H_5NaO_2$
Molecular Weight 144.10

TEST	SPECIFICATION	LOT 09519HA RESULTS
APPEARANCE	WHITE POWDER OR CRYSTALS	WHITE POWDER
INFRARED SPECTRUM	CONFORMS TO STRUCTURE AND STANDARD.	CONFORMS TO STRUCTURE AND STANDARD
TITRATION	98.5% - 101.5% (WITH HCLO4)	99.1% (WITH HCLO4)
HIGH PRESSURE LIQUID CHROMATOGRAPHY	98.5% (MINIMUM)	99.5%
QUALITY CONTROL ACCEPTANCE DATE		JULY 2002

APPENDIX F - PROTOCOL

- PROTOCOL -

Study Title: READY BIODEGRADABILITY: OECD 301F Manometric Respirometry Test

EMBSI Study Number: 0545979

Test Substance: MRD-05-459

Date: 30-Nov-05

Room Number: LG361

Proposed Key Dates:

Experimental Start 22-Dec-05
Experimental Termination.....19-Jan-06
Draft Report Completion.....23-Feb-06
Final Report Completion 7-Apr-06

Approved By:

[redacted]

7 Dec 05
Date

ExxonMobil Biomedical Sciences, Inc.
1545 Route 22 East, P.O. Box 971
Annandale, New Jersey 08801-0971

[redacted]

12/2/05
Date

SAFETY FIRST

APPENDIX F - PROTOCOL (CONT'D)

INTRODUCTION

Objective

This study will be conducted for the Sponsor in order to evaluate the potential of the test substance to biodegrade in an aerobic, aqueous environment for use in environmental hazard assessment.

Sponsor

American Petroleum Institute
1220 L Street, NW
Washington, DC 20005-4070

Testing Facilities

ExxonMobil Biomedical Sciences Inc. (EMBSI)
Laboratory Operations
1545 Route 22 East, P.O. Box 971
Annandale, New Jersey 08801-0971

Quantitative Technologies Inc. (QTI) (Elemental Analysis Only)
P.O. Box 470
Salem Industrial Park, Bldg 5
Whitehouse, New Jersey 08888

Compliance

This study will be performed in general agreement with the OECD 301F test method[1] with the exceptions listed on page 8.

The study will be conducted in compliance with OECD and USEPA Good Laboratory Practice (GLP) standards[2, 3].

Justification for Selection of Test System

Selection of the aerobic aquatic biodegradation test is based upon the OECD Guideline[1]. The test method determines biodegradability by measuring oxygen consumption in a system consisting of an activated sludge supernatant, test substance and a nutrient source. Further, activated sludge has historically been used to evaluate the persistence of chemicals in the environment.

Justification of Dosing Route

The test substance could possibly be found in aqueous solution in a wastewater treatment facility.

APPENDIX F - PROTOCOL (CONT'D)

MATERIALS AND METHODS

Test Substance Identification

EMBSI code	Sponsor's Identification
MRD-05-459	High Naphthenic, Heavy, Straight-Run Naphtha

Storage Conditions: The neat test substance will be stored at room temperature.

Characterization of Test Substance

Pre-test and post-test characterization and stability analysis will include the following determinations: FT-IR and UV-Vis spectra, density, physical-state, miscibility in water, methanol and/or hexane and GC-MS "fingerprint" of the neat test substance. The GC-MS fingerprint is run against an ASTM hydrocarbon standard mixture. The ASTM D2887 standard will be applied for higher boiling mixtures with compounds eluting between approximately n-octane (n-C8) and n-triacontane (n-C30). For more volatile test mixtures, an ASTM D3710 standard is used for compounds eluting between approximately n-heptane (n-C6) and n-pentadecane (n-C15). Due to the complex nature of the test substance, no attempt will be made to identify specific hydrocarbon components. Instead, an area percent report will be generated for both the pre- and post-test analysis to demonstrate stability of the test substance over the testing period. Documentation of characterization and stability assessment will be maintained at the testing facility and the results appended to the final report.

An aliquot of the test substance will be sent to Quantitative Technologies Inc. (QTI) for elemental analysis, specifically carbon, hydrogen, nitrogen and oxygen. The Carbon, Hydrogen, Nitrogen, and Oxygen will be determined using a Perkin-Elmer 2400 CHN Elemental Analyzer equipped with an oxygen accessory kit. For CHN the analyzer will use combustion to convert the sample elements to simple gases. Upon entering the analyzer, the sample will be combusted in a pure oxygen environment. The product gases will be separated under steady state conditions, and measured as a function of thermal conductivity. For oxygen, pyrolysis will be used to convert the oxygen to carbon monoxide which will be separated from the other pyrolozates under steady state conditions and measured as a function of thermal conductivity. This laboratory is not a GLP compliant facility and therefore may not have performed the analysis in a GLP compliant manner. However, a standard (acetanilide) will be employed to monitor the quality of the data. The manufacturer and a copy of the certificate of analysis will be included in the final report. If values are outside of the standard limits, the analysis will be repeated.

The methods of synthesis, fabrication, and/or derivation of the test substance will be maintained by the sponsor. The test substance, as received, will be considered the "pure" substance.

APPENDIX F - PROTOCOL (CONT'D)

MATERIALS AND METHODS (CONT'D)

Positive Control Substance

Substance Identification: Sodium Benzoate
Manufacturer - Aldrich Chemical Company

Storage Conditions: Neat substance will be stored at room temperature.

Documents which detail the stability, identity, solubility, strength, purity and composition or other characteristics which appropriately identify the positive control substance were provided by the manufacturer. The document is a certificate of analysis. Copies of the document will be included in the raw data and final report.

Vehicle

Glass distilled water will be used as the vehicle. The glass distilled water is prepared from UV sterilized deionized well water that is treated and distributed throughout the testing facility via PVC and stainless steel pipes. The feed water for the deionized water system is analyzed by Accutest®, 2235 Route 130, Dayton, New Jersey 08810. Results of the water analyses are maintained at the testing facility. There are no known contaminants in the water believed to be present at levels that may interfere with this study. Contaminant analysis of the water is not performed in a GLP compliant manner. This is not believed to have an adverse affect on the study results. The laboratory is accredited by the National Environmental Laboratory Accreditation Conference (NELAC) and has been audited by ExxonMobil Biomedical Sciences, Inc. using the Quality Practices and Guidelines (QP & G v. 5.1). The analyses are performed using standard US EPA methods.

Inoculum

The inoculum will be fresh activated sludge obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, New Jersey. This source has been selected since the treatment facility deals predominantly with domestic sewage as specified in the guideline. There are no known contaminants in the fresh activated sludge believed to be present at levels that may interfere with this study. Fresh activated sludge will be obtained on Day -1 of the Manometric Respirometry Test. The total suspended solids (TSS) concentration of the sludge will be confirmed and adjusted, if necessary, prior to use (3-5 g/L). A 10 mL aliquot of the mixed sludge will be filtered through a pre-weighed Whatman 934-AH filter pad in a Buchner filter and vacuum flask set up. The filter pad will be placed in an aluminum pan and dried in an oven set at 105°C ± 5°C for at least one hour. After cooling, the filter will be reweighed and the TSS determined. This procedure will be performed in duplicate and the average value will be reported.

APPENDIX F - PROTOCOL (CONT'D)

MATERIALS AND METHODS (CONT'D)

Inoculum (cont'd)

The sludge will be homogenized for 2 minutes in a blender at low speed. The homogenized sample will be allowed to settle for at least 30 minutes, after which the supernatant will be decanted (avoiding carry-over of sludge solids). Settling time will be dictated by the clarity of the supernatant. An aliquot of the supernatant will be used for final preparation of the test medium (see test medium preparation). An aliquot of the remaining supernatant will be used to determine microbial activity with an Easicult®-TTC dip slide. This will be accomplished by removing the agar stick from the culturing tube, and dipping the agar into the supernatant aliquot. Excess supernatant will be blotted off with a clean paper towel, and the agar stick will then be placed back into the culture tube. The whole unit will be placed into a dark Environmental Chamber for 48 hours at 20 ± 1°C. After 48 hours, the whole unit will be observed, and the density of the colonies growing on the medium will be compared to the model density chart provided by the supplier.

Solutions

Mineral Salt Solutions:	Phosphate buffer pH 7.2
	Ferric chloride (0.025%)
	Magnesium sulfate (2.25%)
	Calcium chloride (2.75%)

The manufacturer and lot number for each solution will be recorded in both the raw data and the report. There are no known contaminants in the solutions believed to be present at levels that may interfere with this study. All solutions will be refrigerated when not in use.

Test Medium

The test medium will be prepared at least one day before the test begins. One or two carboys (glass or nalgene) will each be filled with sufficient volume of glass distilled water depending on the volume required for the number of replicate chambers being prepared. The following additions of mineral salts will be made to each carboy:

1 mL of magnesium sulfate solution per liter of glass distilled water
1 mL of calcium chloride solution per liter of glass distilled water
10 mL of phosphate buffer solution per liter of glass distilled water
1 mL of ferric chloride solution per liter of glass distilled water

APPENDIX F - PROTOCOL (CONT'D)

MATERIALS AND METHODS (CONT'D)

Test Medium (cont'd)

Final preparation of the test medium is achieved on Day -1 by adding 10 mL of the activated sludge supernatant (see preparation as described in the inoculum section) per liter of glass distilled water to each carboy.

Sodium Benzoate Stock Solution: A stock solution of sodium benzoate will be prepared in glass distilled water. The stock solution will be refrigerated when not in use. Stock solution concentration will be confirmed by Total Organic Carbon (TOC) analysis as per SOP G.2.8.28. The pH of the stock will be measured, and adjusted to 7.4± 0.2 if necessary.

Test System

The test system will be considered as any combination of the following in a test container:

Test or Positive Control Substance
Test Medium (containing the following):
- Mineral Salt Solutions
- Activated Sludge Supernatant
- Glass Distilled Water

All test containers used in this study will be uniquely identified as to appropriate composition, i.e., Blank - 1, 2, 3; MRD-05-459 - 1, 2, 3; etc. More than one test substance may be tested concurrently using the same set of blanks and positive control substance test systems. All glassware will be washed with Chemsolve® glassware cleaner, then rinsed with glass distilled H_2O to remove any residual organic carbon prior to use. The glassware will be inspected for cleanliness before use. The manometric cells will be rinsed with two portions of acetone, then filled with soapy water and allowed to stand for a few hours. The cells will then be rinsed with glass distilled water and rinsed one more time with acetone then finally air dried.

APPENDIX F - PROTOCOL (CONT'D)

EXPERIMENTAL PROCEDURE

Procedure Summary

The test procedure evaluates the ready biodegradability of a test substance by microorganisms in water. The consumption of oxygen is determined by measuring the quantity of oxygen (produced electrolytically) required to maintain constant gas volume in the respirometer flask, or from the change in volume or pressure (or a combination of the two) in the apparatus. Evolved carbon dioxide is absorbed in a solution of potassium hydroxide or another suitable absorbent. The amount of oxygen taken up by the microbial population during biodegradation of the test substance (corrected for uptake by blank inoculum, run in parallel) is expressed as a percentage of theoretical oxygen demand (ThOD). ThOD will be calculated based on the chemical structure supplied by the sponsor or elemental analysis, performed by QTI, and using the equation found in the OECD guideline[1]. This test is performed in general agreement with the OECD guideline[1] with the following clarifications/exceptions:

Clarification

1. The apparatus is an electrolytic respirometer, manufactured by Co-ordinated Environmental Service, Ltd. (Kent, England). The system is based on a proven oxygen generating process coupled to a sensitive manometric cell. The sample is placed in a sample flask, which is then sealed by a manometric cell/CO_2 trap and immersed in a temperature stabilized water bath. For the duration of the experiment, the sample is stirred by a magnetically coupled stirrer. As the biodegradation process progresses, the microorganisms convert O_2 to CO_2. The CO_2 is absorbed by the alkali CO_2 trap and causes a net reduction in gas pressure within the sample flask. This pressure reduction is detected by the manometric cell and triggers the electrolytic process. This generates oxygen and restores the pressure in the sample flask. The magnitude of the electrolyzing current and the duration of the current is proportional to the amount of oxygen supplied to the microorganisms.

2. The test and positive control substance will be tested at concentrations of approximately 50 mg/L. Sodium Benzoate will be administered to the appropriate replicate chambers as an aliquot of an aqueous stock solution. The test substance will be administered neat by direct addition in a manner that will minimize loss due to volatilization. An aqueous stock solution will not be prepared for the test substance because of the low water solubility. Also no concentration verification will be performed since the test substance is poorly soluble in water.

APPENDIX F - PROTOCOL (CONT'D)

EXPERIMENTAL PROCEDURE (CONT'D)

Clarification (cont'd)

3. The blank, positive control and test substance test solutions will be tested in triplicate.

4. Preparing the test medium containing the microorganisms on a large volume basis will minimize bias. In addition the test medium will be aerated for 24 hours to improve homogeneity and ensure random distribution of test organisms to all replicates. The pH of the test medium will be determined and adjusted if it falls outside the range of 7.4 ± 0.2. The initial pH of individual solutions will not be determined due to the poor solubility of the test substance in water.

5. Dissolved organic carbon (DOC) analysis will not be performed due to the poor solubility of the test substance.

6. The test duration (normally 28 days) may be shortened or extended based on the biodegradation curve.

Exceptions

1. No abiotic sterile or toxicity control treatments will be tested.

2. Test medium will be prepared on a large volume basis, aerated and aliquoted into each test container, instead of preparation in the individual replicates.

3. The commercial phosphate buffer, used in preparation of the test medium, has a pH value of 7.2 rather than 7.4. The phosphate buffer, purchased from VWR, has been approved by the American Public Health Association (APHA) for use in the Biological Oxygen Demand (BOD) analysis. The BOD buffer has the same composition as the buffer stated in the OECD guideline[1].

4. The inoculum will be mixed for 2 minutes in a blender at low speed, instead of medium speed.

APPENDIX F - PROTOCOL (CONT'D)

EXPERIMENTAL PROCEDURE (CONT'D)

Preparation of the Test Systems

Test System Aerobic Respirometer	Test Substance Concentration	Test Medium
Blank - 1, 2, 3	None	Add 1 liter of test medium
Sodium Benzoate - 1, 2, 3	≈50 mg via stock solution	Add 1 liter of test medium
MRD-05-459 - 1, 2, 3	≈ 50 mg of test substance	Add 1 liter of test medium

The test systems will be assembled in accordance with the manufacturer's directions and labeled as shown above. Test systems will be prepared as indicated in the table above on Day 0. The test substance will be added directly into each replicate test flasks containing test medium with a syringe. The weight difference of the syringe will be recorded as the weight of test substance added to the flask. Each flask will be sealed immediately after addition of the test substance to avoid loss due to volatilization. Stirring will be initiated, the equipment will be checked to ensure no leaks are present, and oxygen uptake measurements will begin. No further attention is required other than printing the respirometer data and ensuring that adequate stirring is maintained during normal working hours. The water bath temperature of 22 ± 1°C will be monitored by the Watchdog V5 Monitoring System but manual temperature measurements may also be recorded. At the end of incubation, normally 28 days, the pH of the contents of the flasks will be measured.

Calculations

Percent biodegradation values are calculated by the respirometer software, using the ThOD, and the mass of test substance added. The ThOD will be calculated as specified in Annex IV of OECD guideline[1]. The software incorporates the hourly logged oxygen uptake value along with the entered parameters into the following calculations to derive the percent biodegradation.

$$Constant = 100 \frac{1}{ThOD \times mg\ test\ substance\ in\ vessel}$$

Percent Biodegradation (%) = (mg O_2 uptake by test substance - mean mg O_2 uptake by blank) x constant

The mg of oxygen consumed by the blank represents the average oxygen consumption for the triplicate blank replicates. The mean and standard deviation of the percent biodegradation for each test substance will be calculated in Microsoft® Excel 97. Due to the calculation process of Microsoft® Excel 97 some rounding differences may be noted.

APPENDIX F - PROTOCOL (CONT'D)

EXPERIMENTAL PROCEDURE (CONT'D)

Validity of Results

The test shall be considered valid if the difference of extremes of replicate values reported for the biodegradation of the test substance is less than 20% by Day 28 and if the reference substance reaches the pass level of 60% of the theoretical oxygen demand by Day 14. If either of these conditions is not met, the test should be repeated.

The oxygen uptake of the inoculum blank is normally 20-30 mg O_2/L and should not be greater than 60 mg/L in 28 days. Values higher than 60 mg/L require critical examination of the data and experimental technique. If the pH value is outside the range of 6-8.5 and the oxygen consumption by the test substance is less than 60%, the test should be repeated with a lower concentration of the test substance.

Classification of Ready Biodegradability

A test substance shall be classified as readily biodegradable if the percent biodegradation reaches 60% within 28 days and the 60% degradation has been attained within 10 days of exceeding 10% biodegradation.

APPENDIX F - PROTOCOL (CONT'D)

READY BIODEGRADABILITY: MANOMETRIC RESPIROMETRY TEST
MRD-05-459, STUDY NUMBER 0545979

REPORTS

After termination of the study, a final report, which includes the following information, will be submitted:

1. Signature of the study director, laboratory director and date.
2. Name of the study director and laboratory director.
3. Statements of results as mean percent of biodegradation for the test and positive control substance.
4. Name and address of the testing facility and sponsor.
5. Identification of the test substance.
6. Positive control substance identification, lot number and manufacturer name.
7. The location of storage for neat test substance, raw data, and the final report.
8. Description of reagents and solutions.
9. Key study dates.
10. Inoculum information including location of source, handling, method of biomass determination, total suspended solids (TSS), and microbial concentration (CFU/mL).
11. Objectives and procedures stated in the approved protocol including any changes in the original protocol. A copy of the protocol and protocol amendments.
12. Circumstances, if any, which may have affected the quality or integrity of the data.
13. Description of methods used, including test apparatus description.
14. Amount of each test substance used and method of addition.
15. Incubation temperature range.
16. Description of calculations, summary and analysis of the data, and a graph of the percent biodegradation of each test substance versus time.
17. Q. A. and Compliance Statements.

APPENDIX F - PROTOCOL (CONT'D)

QUALITY ASSURANCE

The Quality Assurance Unit of ExxonMobil Biomedical Sciences, Inc. will audit the protocol, conduct study based phase inspection(s) and audit the draft final report (before sponsor review) to assure that they are in conformance with the appropriate guidelines, company standard operating procedures (SOPs), and Good Laboratory Practice regulations.

RECORDS

All appropriate materials, methods and experimental measurements required in this protocol will be recorded and documented in the raw data. Any changes, additions or revisions of this protocol must be approved by the Study Director and the Sponsor Representative. These changes will be documented in writing, including the date, the justification for the change and the signatures of the Study Director and Sponsor Representative.

The protocol, final report, raw data or computer-generated listings of raw data, supporting study documentation and a non-study specific sample of the neat test substance will be maintained in the archives of the testing facility for 10 years, after which time the records will be offered to the sponsor prior to disposal.

REFERENCES

1. Organization for Economic Cooperation and Development (OECD), Guidelines for the Testing of Chemicals, Ready Biodegradability, 301F Manometric Respirometry Test (1992).

2. Organization for Economic Cooperation and Development, Principles of Good Laboratory Practice, C(97) 186/Final, 1997.

3. United States Environmental Protection Agency (USEPA) Toxic Substances Control Act (TSCA), Good Laboratory Practice Standards, 40 CFR Part 792, 1989.

APPENDIX F - PROTOCOL (CONT'D)

READY BIODEGRADABILITY: MANOMETRIC RESPIROMETRY TEST
MRD-05-459, STUDY NUMBER 0545979

PERSONNEL

Study Director .....
Sponsor Representative.....
Primary Study Technician.....
Laboratory Coordinator .....
Analytical Chemistry .....
Compound Prep.....
QA ....
Contract Administrator .....

[redacted]

APPENDIX F - PROTOCOL (CONT'D)

PROTOCOL CHANGE RECORD Page 1 of 2
READY BIODEGRADABILITY:
OECD 301F, Manometric Respirometry Test on High Naphthenic, Heavy, Straight-Run Naphtha

This record must be approved by the Sponsor Representative and the Study Director for all protocol changes made subsequent to initial distribution. Upon completion, a copy of this record must be distributed to all recipients of the protocol and the original submitted to the Archivist.

Study Number: 0545979 Revision Number: 1 Date: 15-Dec-05

Pg. 7 / Clarification:

Additional Statement:
The toxicity control will contain approximately 50 mg/L of both the test and positive control substances.

Pg. 8 / Clarification:

Previous Statement:
3. The blank, positive control and test substance test solutions will be tested in triplicate.

Revised Statement:
3. The blank, positive control, toxicity control and test substance test solutions will be tested in triplicate.

Pg. 9 / *Preparation of the Test Systems*

Previous Statement:

Test System Aerobic Respirometer	Test Substance Concentration	Test Medium
Blank - 1, 2, 3	None	Add 1 liter of test medium
Sodium Benzoate - 1, 2, 3	≈50 mg via stock solution	Add 1 liter of test medium
MRD-05-459 - 1, 2, 3	≈ 50 mg of test substance	Add 1 liter of test medium

Revised Statement:

Test System Aerobic Respirometer	Test Substance Concentration	Test Medium
Blank - 1, 2, 3	None	Add 1 liter of test medium
Sodium Benzoate - 1, 2, 3	≈50 mg via stock solution	Add 1 liter of test medium
Toxicity Control - 1, 2, 3	≈50 mg Sodium Benzoate via stock solution ≈ 50 mg of test substance	Add 1 liter of test medium
MRD-05-459 - 1, 2, 3	≈ 50 mg of test substance	Add 1 liter of test medium

APPENDIX F - PROTOCOL (CONT'D)

PROTOCOL CHANGE RECORD
READY BIODEGRADABILITY:
OECD 301F, Manometric Respirometry Test on High Naphthenic, Heavy, Straight-Run Naphtha

Study Number: 0545979 Revision Number: 1 Date: 15-Dec-05

Pg. 10 / *Validity of Results*:

Additional Statement:
The test substance will be considered inhibitory if the toxicity test systems, containing both the test and positive control substance, do not attain 25% biodegradation by Day 14.

Pg. 11 / *REPORTS*:

Previous Statement:
3. Statements of results as mean percent of biodegradation for the test and positive control substance.

Revised Statement:
3. Statements of results as mean percent of biodegradation for the test and positive control substance and the toxicity control.

Justification: addition of toxicity control treatment

Required signatures:

[redacted]

1/09/06
Date

[redacted]

12 Jan 06
Date

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA

1. **Detailed Hydrocarbon Analyses – Refinery Sample**
2. **Detailed Hydrocarbon Analyses – Comparison of Three Sample Drums**
3. **Intertek Caleb Brett Sample, Physical–Chemical Analyses**
4. **Intertek Caleb Brett Reid Vapor Pressure Analysis**

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

Background

The chemical analyses cited within this appendix was conducted to provide the American Petroleum Institute's (API) Petroleum HPV Testing Group with a set of pre-test physical-chemical data on a sample of high naphthenic naphtha (CAS Number 64741-78-2)*. This gasoline blending stream was selected for specific tests described in the Gasoline Blending Streams Test Plan and submitted to the U.S. Environmental Protection Agency (EPA) as part of EPA's High Production Volume (HPV) test program.

The data are presented in chronological order in which the analyses were performed and includes the following:

1. Detailed hydrocarbon analysis of the high naphthenic naphtha test sample performed by the refinery. The analysis presents a component list of the molecular composition of the test sample. The composition was additionally summarized by both hydrocarbon group type (e.g., aromatics, iso-paraffins, naphthenes, olefins, paraffins, oxygenates and unidentified components) and carbon number.

2. Detailed hydrocarbon analyses of a sample from each of three drums received by the archival facility. It was discovered by the archival facility that one drum was only partially filled. Due to a concern for potential loss of volatile components in the drum headspace, a sample from each of the three drums was returned to the refinery for detailed hydrocarbon analyses. Comparison of the proportions of hydrocarbon group type in each sample showed no appreciable differences in component proportions among the three drums.

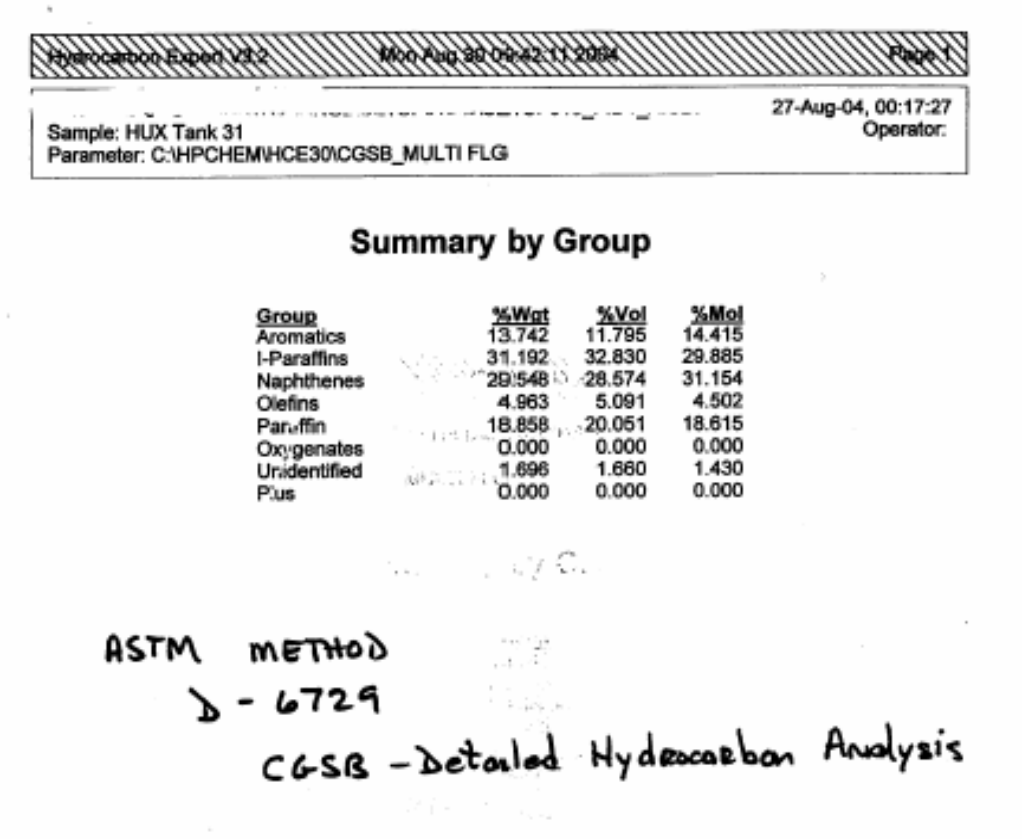
3. Physical-chemical analyses conducted by Intertek Caleb Brett (Deer Park, Texas). This suite of 10 physical-chemical tests defined the pre-test characterization of the test sample. A sample was taken from one of the three drums and was considered to represent the entire lot of material.

4. Analysis of Reid vapor pressure by Intertek Caleb Brett. This was run as a check against the dry vapor pressure performed in Intertek Caleb Brett's initial characterization. Results by both methods showed a relatively low vapor pressure that fell at the low end of each method's limit of sensitivity.

* An explanation of the Chemical Abstract Service (CAS) number designation for this test sample is provided in Appendix H.

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample



Hydrocarbon Expert v3.2 Mon Aug 30 09:42:11 2004 Page 1

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

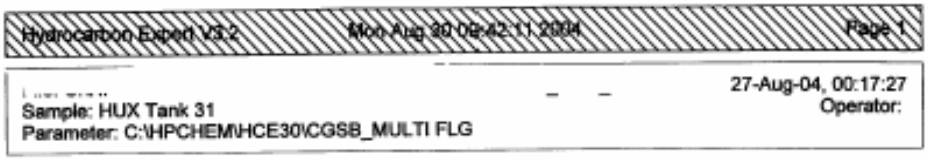
Summary by Group

Group	%Wgt	%Vol	%Mol
Aromatics	13.742	11.795	14.415
I-Paraffins	31.192	32.830	29.885
Naphthenes	29.548	28.574	31.154
Olefins	4.963	5.091	4.502
Paraffin	18.858	20.051	18.615
Oxygenates	0.000	0.000	0.000
Unidentified	1.696	1.660	1.430
Plus	0.000	0.000	0.000

ASTM METHOD
D - 6729
CGSB - Detailed Hydrocarbon Analysis

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



Composite by Carbon

Group	C#	%Wgt	%Vol	%Mol
Aromatics	C6	0.109	0.093	0.157
	C7	3.707	3.191	4.510
	C8	4.912	4.223	5.186
	C9	3.881	3.315	3.623
	C10	1.033	0.888	0.863
	C11	0.099	0.085	0.076
I-Paraffins	C6	0.159	0.179	0.206
	C7	7.875	8.611	8.809
	C8	9.781	10.344	9.598
	C9	8.771	9.039	7.664
	C10	4.020	4.079	3.167
	C11	0.578	0.569	0.435
	C12	0.009	0.009	0.006
Naphthenes	C6	1.183	1.159	1.575
	C7	12.754	12.483	14.561
	C8	11.109	10.699	11.100
	C9	3.605	3.396	3.201
	C10	0.897	0.837	0.717
Olefins	C7	0.200	0.210	0.201
	C8	0.860	0.896	0.859
	C9	3.629	3.709	3.223
	C10	0.274	0.277	0.219
Paraffin	C6	0.183	0.207	0.239
	C7	6.727	7.339	7.525
	C8	5.571	5.913	5.466
	C9	4.325	4.495	3.780
	C10	1.893	1.935	1.491
	C11	0.154	0.155	0.110
	C12	0.005	0.005	0.003

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 1

27-Aug-04, 00:17:27
Sample: HUX Tank 31
Operator:
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

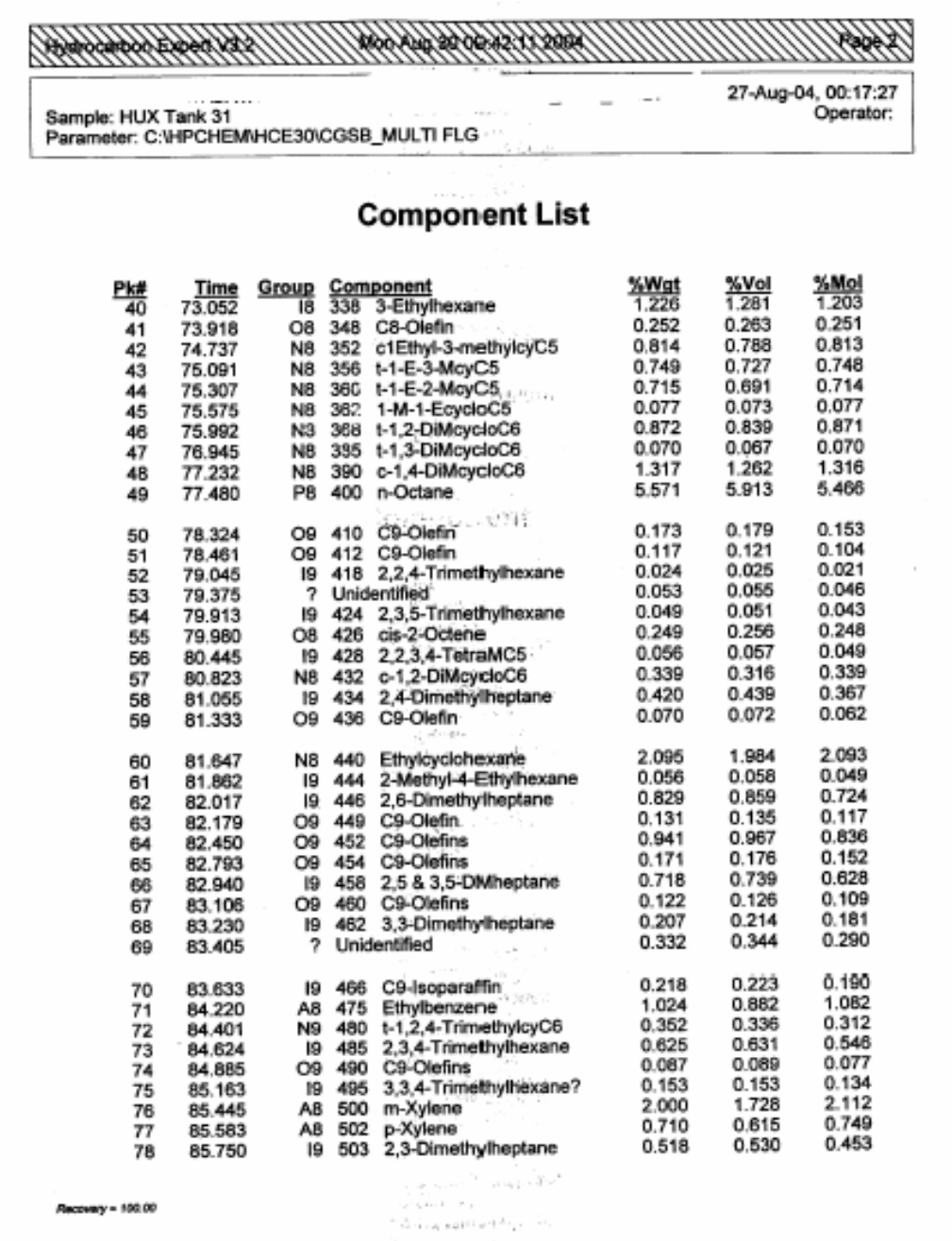
Component List

Pk#	Time	Group		Component	%Wgt	%Vol	%Mol
1	27.947	I6	64	2,3-Dimethylbutane	0.008	0.009	0.010
2	29.002	I6	74	2-Methylpentane	0.065	0.075	0.085
3	31.636	I6	80	3-Methylpentane	0.086	0.096	0.111
4	35.357	P6	96	n-Hexane	0.183	0.207	0.239
5	40.146	N6	112	McyC5+2,2DMC5	0.679	0.676	0.904
6	41.766	I7	116	2,4-Dimethylpentane	0.143	0.158	0.160
7	45.127	A6	130	Benzene	0.109	0.093	0.157
8	46.727	I7	134	33DMC5+5m1C6ene	0.046	0.050	0.052
9	48.992	N6	136	Cyclohexane	0.504	0.483	0.671
10	50.190	I7	156	2-MethylC6 + C7-Olefin	4.159	4.571	4.652
11	52.019	I7	166	3-Methylhexane	3.284	3.572	3.673
12	52.814	N7	172	t-1,3-DimethylcyC5	1.487	1.472	1.698
13	53.391	N7	174	c-1,3-DMcyclopentane	1.349	1.344	1.540
14	54.007	N7	176	t-1,2-DimethylcycloC5	1.632	1.621	1.863
15	54.168	I7	180	3-Ethylpentane	0.244	0.260	0.273
16	54.624	I8	186	2,2,4-Trimethylpentane	0.040	0.043	0.039
17	55.001	O7	189	C7-Olefin	0.008	0.008	0.009
18	57.634	P7	200	n-Heptane	6.727	7.339	7.525
19	60.995	N7	222	Methylcyclohexane	7.067	6.858	8.068
20	61.881	N8	224	1,1,3-TrimethylcycloC5	0.486	0.485	0.485
21	62.330	I8	226	2,2-Dimethylhexane	0.062	0.066	0.061
22	63.709	N7	234	Ethylcyclopentane	1.219	1.188	1.392
23	64.404	I8	240	2,2,3-Trimethylpentane	0.011	0.012	0.011
24	64.637	I8	245	2,5-DMC6 + C8-olefin	0.504	0.539	0.494
25	64.970	I8	250	2,4-Dimethylhexane	0.594	0.633	0.583
26	65.777	N8	260	t,c-1,2,4-TriMcyC5	0.949	0.948	0.948
27	66.207	I8	265	3,3-DMC6 + C8-olefin	0.078	0.081	0.076
28	67.294	N8	278	t,c-1,2,3-TriMcycloC5	0.659	0.653	0.658
29	67.933	I8	292	2,3,4-Trimethylpentane	0.067	0.069	0.065
30	68.463	A7	300	Toluene	3.707	3.191	4.510
31	69.951	O8	312	C8-Olefin	0.198	0.207	0.197
32	70.283	I8	314	2,3-Dimethylhexane	0.397	0.416	0.390
33	70.428	I8	316	2-M-3-Epentane	0.159	0.166	0.157
34	71.621	I8	326	2-Methylheptane	3.088	3.301	3.030
35	71.845	I8	328	4-Methylheptane	1.026	1.062	1.007
36	72.065	O7	330	C7-Diolefin + C8-Olefin	0.192	0.202	0.192
37	72.188	O8	333	C8-Olefins	0.162	0.170	0.162
38	72.706	N8	335	t-1,4-DiMcycloC6	1.968	1.866	1.967
39	72.903	I8	336	3-Methylheptane	2.529	2.673	2.482

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



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Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group		Component	%Wgt	%Vol	%Mol
40	73.052	I8	338	3-Ethylhexane	1.226	1.281	1.203
41	73.918	O8	348	C8-Olefin	0.252	0.263	0.251
42	74.737	N8	352	c1Ethyl-3-methylcyC5	0.814	0.788	0.813
43	75.091	N8	356	t-1-E-3-McyC5	0.749	0.727	0.748
44	75.307	N8	360	t-1-E-2-McyC5	0.715	0.691	0.714
45	75.575	N8	362	1-M-1-EcycloC5	0.077	0.073	0.077
46	75.992	N8	368	t-1,2-DiMcycloC6	0.872	0.839	0.871
47	76.945	N8	395	t-1,3-DiMcycloC6	0.070	0.067	0.070
48	77.232	N8	390	c-1,4-DiMcycloC6	1.317	1.262	1.316
49	77.480	P8	400	n-Octane	5.571	5.913	5.466
50	78.324	O9	410	C9-Olefin	0.173	0.179	0.153
51	78.461	O9	412	C9-Olefin	0.117	0.121	0.104
52	79.045	I9	418	2,2,4-Trimethylhexane	0.024	0.025	0.021
53	79.375	?		Unidentified	0.053	0.055	0.046
54	79.913	I9	424	2,3,5-Trimethylhexane	0.049	0.051	0.043
55	79.980	O8	426	cis-2-Octene	0.249	0.256	0.248
56	80.445	I9	428	2,2,3,4-TetraMC5	0.056	0.057	0.049
57	80.823	N8	432	c-1,2-DiMcycloC6	0.339	0.316	0.339
58	81.055	I9	434	2,4-Dimethylheptane	0.420	0.439	0.367
59	81.333	O9	436	C9-Olefin	0.070	0.072	0.062
60	81.647	N8	440	Ethylcyclohexane	2.095	1.984	2.093
61	81.862	I9	444	2-Methyl-4-Ethylhexane	0.056	0.058	0.049
62	82.017	I9	446	2,6-Dimethylheptane	0.829	0.859	0.724
63	82.179	O9	449	C9-Olefin	0.131	0.135	0.117
64	82.450	O9	452	C9-Olefins	0.941	0.967	0.836
65	82.793	O9	454	C9-Olefins	0.171	0.176	0.152
66	82.940	I9	458	2,5 & 3,5-DiMheptane	0.718	0.739	0.628
67	83.106	O9	460	C9-Olefins	0.122	0.126	0.109
68	83.230	I9	462	3,3-Dimethylheptane	0.207	0.214	0.181
69	83.405	?		Unidentified	0.332	0.344	0.290
70	83.633	I9	466	C9-Isoparaffin	0.218	0.223	0.190
71	84.220	A8	475	Ethylbenzene	1.024	0.882	1.082
72	84.401	N9	480	t-1,2,4-TrimethylcyC6	0.352	0.336	0.312
73	84.624	I9	485	2,3,4-Trimethylhexane	0.625	0.631	0.546
74	84.885	O9	490	C9-Olefins	0.087	0.089	0.077
75	85.163	I9	495	3,3,4-Trimethylhexane?	0.153	0.153	0.134
76	85.445	A8	500	m-Xylene	2.000	1.728	2.112
77	85.583	A8	502	p-Xylene	0.710	0.615	0.749
78	85.750	I9	503	2,3-Dimethylheptane	0.518	0.530	0.453

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 Mon Aug 30 09:42:11 2004 Page 3

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI.FLG

27-Aug-04, 00:17:27
Operator:

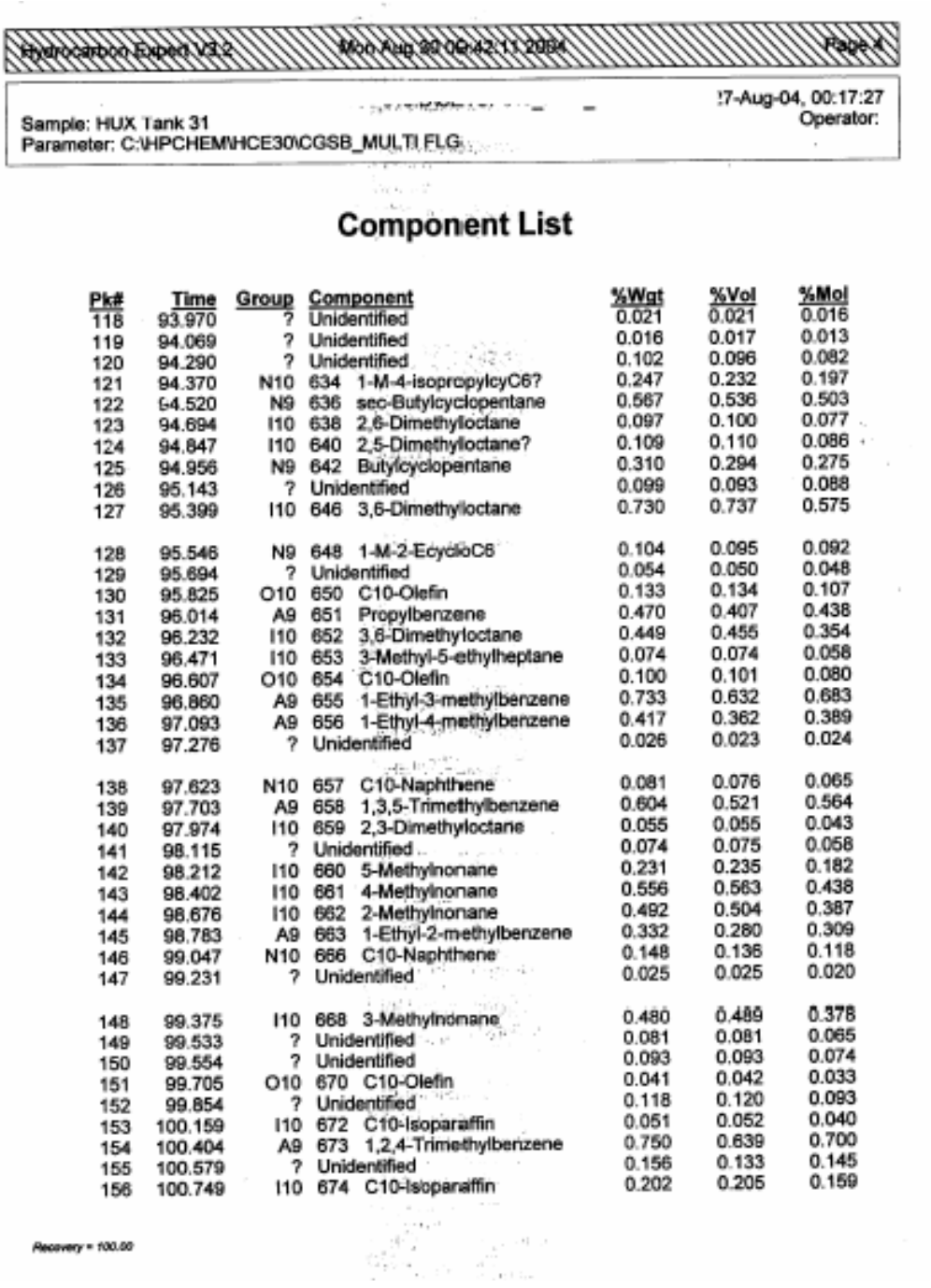
Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
79	85.998	I9	506 3,4-Dimethylheptane	0.064	0.066	0.056
80	86.133	?	Unidentified	0.067	0.069	0.060
81	86.189	O9	508 C9-Olefin	0.150	0.154	0.134
82	86.387	I9	510 3-Methyl-3-ethylhexane	0.246	0.248	0.215
83	86.552	I9	516 4-Ethylheptane	0.101	0.104	0.089
84	86.814	I9	518 4-MC8+C9-Olefin	0.864	0.916	0.773
85	86.954	I9	520 2-Methyloctane	1.215	1.275	1.061
86	87.260	?	Unidentified	0.033	0.035	0.029
87	87.318	I9	524 C9-Isoparaffin	0.139	0.144	0.122
88	87.644	I9	528 3-Ethylheptane	0.371	0.379	0.324
89	87.814	I9	530 3-Methyloctane	1.431	1.473	1.250
90	87.888	O9	535 C9-Olefin	0.137	0.139	0.121
91	88.061	N9	540 c-1,2,4-TriMcyC6	0.092	0.088	0.082
92	88.310	N9	545 1,1,2-TriMcycloC6	0.149	0.145	0.132
93	88.407	A8	550 o-Xylene	1.178	0.999	1.243
94	88.539	O9	560 C9-Olefin	0.089	0.090	0.079
95	88.658	O9	562 C9-Olefin	0.151	0.154	0.134
96	88.869	O9	564 C9-Olefin	0.021	0.021	0.018
97	88.945	?	Unidentified	0.021	0.021	0.019
98	89.236	N9	568 t-1-E-4-M-cyC6?	0.532	0.498	0.473
99	89.390	N9	570 c-1-E-4-McyC6?	0.820	0.767	0.728
100	89.684	I9	572 C9-Isoparaffin	0.427	0.435	0.373
101	90.006	O9	575 1-Nonene	0.099	0.101	0.088
102	90.177	N9	580 Isobutylcyclopentane	0.146	0.139	0.130
103	90.262	?	Unidentified	0.069	0.066	0.062
104	90.329	?	Unidentified	0.015	0.015	0.014
105	90.965	O9	590 cis-3-Nonene	0.066	0.067	0.058
106	91.096	I9	595 C9-Isoparaffin	0.019	0.019	0.016
107	91.328	P9	600 n-Nonane	4.325	4.495	3.780
108	91.746	O9	604 trans-2-Nonene	0.511	0.516	0.453
109	92.094	N9	606 1-M-1-Ecyclohexane	0.170	0.157	0.151
110	92.300	N9	608 1-M-2-PcycloC5	0.017	0.016	0.015
111	92.577	A9	616 Isopropylbenzene	0.130	0.113	0.122
112	92.830	O9	618 cis-2-Nonene	0.029	0.030	0.026
113	92.901	N9	620 tert-Butylcyclopentane	0.117	0.111	0.104
114	93.051	O9	622 C9-Olefins	0.316	0.320	0.281
115	93.288	O9	624 C9-Olefin	0.249	0.252	0.221
116	93.563	N9	626 Isopropylcyclohexane	0.229	0.213	0.204
117	93.819	I10	630 2,2-Dimethyloctane	0.128	0.131	0.101

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



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Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI.FLG

17-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
118	93.970	?	Unidentified	0.021	0.021	0.016
119	94.069	?	Unidentified	0.016	0.017	0.013
120	94.290	?	Unidentified	0.102	0.096	0.082
121	94.370	N10	634 1-M-4-isopropylcyC6?	0.247	0.232	0.197
122	94.520	N9	636 sec-Butylcyclopentane	0.567	0.536	0.503
123	94.694	I10	638 2,6-Dimethyloctane	0.097	0.100	0.077
124	94.847	I10	640 2,5-Dimethyloctane?	0.109	0.110	0.086
125	94.956	N9	642 Butylcyclopentane	0.310	0.294	0.275
126	95.143	?	Unidentified	0.099	0.093	0.088
127	95.399	I10	646 3,6-Dimethyloctane	0.730	0.737	0.575
128	95.546	N9	648 1-M-2-EcycloC6	0.104	0.095	0.092
129	95.694	?	Unidentified	0.054	0.050	0.048
130	95.825	O10	650 C10-Olefin	0.133	0.134	0.107
131	96.014	A9	651 Propylbenzene	0.470	0.407	0.438
132	96.232	I10	652 3,6-Dimethyloctane	0.449	0.455	0.354
133	96.471	I10	653 3-Methyl-5-ethylheptane	0.074	0.074	0.058
134	96.607	O10	654 C10-Olefin	0.100	0.101	0.080
135	96.860	A9	655 1-Ethyl-3-methylbenzene	0.733	0.632	0.683
136	97.093	A9	656 1-Ethyl-4-methylbenzene	0.417	0.362	0.389
137	97.276	?	Unidentified	0.026	0.023	0.024
138	97.623	N10	657 C10-Naphthene	0.081	0.076	0.065
139	97.703	A9	658 1,3,5-Trimethylbenzene	0.604	0.521	0.564
140	97.974	I10	659 2,3-Dimethyloctane	0.055	0.055	0.043
141	98.115	?	Unidentified	0.074	0.075	0.058
142	98.212	I10	660 5-Methylnonane	0.231	0.235	0.182
143	98.402	I10	661 4-Methylnonane	0.556	0.563	0.438
144	98.676	I10	662 2-Methylnonane	0.492	0.504	0.387
145	98.783	A9	663 1-Ethyl-2-methylbenzene	0.332	0.280	0.309
146	99.047	N10	666 C10-Naphthene	0.148	0.136	0.118
147	99.231	?	Unidentified	0.025	0.025	0.020
148	99.375	I10	668 3-Methylnonane	0.480	0.489	0.378
149	99.533	?	Unidentified	0.081	0.081	0.065
150	99.554	?	Unidentified	0.093	0.093	0.074
151	99.705	O10	670 C10-Olefin	0.041	0.042	0.033
152	99.854	?	Unidentified	0.118	0.120	0.093
153	100.159	I10	672 C10-Isoparaffin	0.051	0.052	0.040
154	100.404	A9	673 1,2,4-Trimethylbenzene	0.750	0.639	0.700
155	100.579	?	Unidentified	0.156	0.133	0.145
156	100.749	I10	674 C10-Isoparaffin	0.202	0.205	0.159

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 5

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group	Component	%Wgt	%Vol	%Mol
157	100.899	I10	675 C10-Isoparaffin	0.176	0.179	0.138
158	101.052	I10	676 Isobutylcyclohexane	0.075	0.070	0.059
159	101.239	?	Unidentified	0.019	0.020	0.016
160	101.342	N10	677 C10-Isoparaffin	0.071	0.072	0.057
161	101.492	I10	678 C10-Isoparaffin	0.031	0.032	0.025
162	101.616	I10	682 C10-Isoparaffin	0.009	0.009	0.007
163	101.815	A10	690 Isobutylbenzene	0.046	0.040	0.039
164	102.017	I10	694 C10-Isoparaffin	0.077	0.078	0.061
165	102.309	P10	700 n-Decane	1.893	1.935	1.491
166	102.602	I11	702 C11-Isoparaffin	0.019	0.019	0.013
167	102.817	?	Unidentified	0.033	0.034	0.024
168	103.062	I11	704 C11-Isoparaffin	0.025	0.025	0.018
169	103.257	A9	705 1,2,3-Trimethylbenzene	0.276	0.230	0.257
170	103.454	?	Unidentified	0.020	0.017	0.017
171	103.531	A10	706 1-M-3-isopropylbenzene	0.016	0.014	0.014
172	103.688	A10	708 1-M-4-isopropylbenzene	0.039	0.034	0.033
173	103.871	I11	709 C11-Isoparaffin	0.085	0.086	0.061
174	104.089	I11	710 C11-Isoparaffin?	0.012	0.012	0.009
175	104.280	?	Unidentified	0.016	0.012	0.015
176	104.426	A9	712 2,3-Dihydroindene	0.169	0.131	0.160
177	104.724	N10	714 sec-Butylcyclohexane	0.238	0.218	0.191
178	104.804	?	Unidentified	0.036	0.037	0.026
179	104.992	?	Unidentified	0.008	0.007	0.007
180	105.219	I11	720 3-Ethylnonane	0.061	0.062	0.044
181	105.330	I11	721 C11-Isoparaffin	0.038	0.039	0.028
182	105.484	N10	722 C10-Naphthene	0.112	0.103	0.089
183	105.802	I11	723 C11-Isoparaffin	0.122	0.122	0.109
184	105.990	A10	724 1,3-Diethylbenzene	0.051	0.044	0.043
185	106.244	A10	725 1-M-3-propylbenzene	0.197	0.170	0.164
186	106.432	A10	726 1,4-Diethylbenzene	0.019	0.016	0.016
187	106.604	A10	727 1-M-4-propylbenzene	0.059	0.051	0.049
188	106.710	A10	728 Butylbenzene	0.061	0.053	0.051
189	106.836	A10	729 3,5-DM-1-Ebenzene	0.067	0.058	0.056
190	106.996	?	Unidentified	0.029	0.025	0.024
191	107.116	A10	730 1,2-Diethylbenzene?	0.029	0.025	0.024
192	107.371	I11	732 C11-Isoparaffin	0.031	0.031	0.022
193	107.560	A10	736 C10-Aromatic	0.033	0.028	0.028
194	107.670	A10	738 C10-Aromatic	0.087	0.075	0.073
195	107.823	A10	740 1-M-2-propyl benzene	0.064	0.054	0.053

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 Mon Aug 30 09:42:11 2004 Page 5

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Component List

Pk#	Time	Group		Component	%Wgt	%Vol	%Mol
196	107.977	?		Unidentified	0.005	0.005	0.004
197	108.091	I11	748	4-Methyldecane	0.059	0.055	0.042
198	108.392	I11	754	C11-Isoparaffin	0.065	0.061	0.047
199	108.528	A10	756	1,4-DM-2-Ebenzene	0.059	0.050	0.049
200	108.691	A10	758	1,3-DM-4-Ebenzene	0.053	0.045	0.044
201	108.819	I11	762	3-Methyldecane	0.016	0.016	0.011
202	108.938	?		Unidentified	0.058	0.058	0.042
203	109.198	A10	764	1,2-DM-4-Ebenz+C1indan	0.068	0.058	0.057
204	109.391	I11	766	C11-Isoparaffin	0.010	0.010	0.007
205	109.747	A10	768	1,3-DM-2-Ebenzene	0.029	0.024	0.024
206	109.880	?		Unidentified	0.006	0.005	0.005
207	110.001	?		Unidentified	0.008	0.008	0.006
208	110.178	I11	770	C11-Isoparaffin	0.018	0.017	0.013
209	110.511	I11	775	C11-Isoparaffin	0.015	0.014	0.011
210	110.732	A11	780	1-M-4-tert-butylbenzene	0.021	0.018	0.016
211	110.857	A10	785	1,2-DM-3-ethylbenzene	0.024	0.020	0.020
212	111.189	P11	800	n-Undecane	0.154	0.155	0.110
213	111.367	A11	802	1-E-4-isopropylbenzene	0.020	0.018	0.015
214	111.800	A10	806	1,2,4,5-TetraMbenzene	0.011	0.009	0.009
215	112.062	A10	810	1,2,3,5-TetraMbenzene	0.020	0.017	0.017
216	112.402	I12	812	C12-Isoparaffin	0.009	0.009	0.006
217	112.634	A11	816	C11-Aromatic	0.009	0.007	0.006
218	113.375	A11	826	1-Ethyl-2-propylbenzene	0.012	0.010	0.009
219	113.916	A11	832	C11-Aromatic	0.004	0.004	0.003
220	114.126	A11	834	1-Methyl-3-butylbenzene	0.012	0.010	0.009
221	114.386	A11	836	1,2,3,4-TetraMbz+C11aro	0.010	0.009	0.009
222	114.894	A11	842	C11-Aromatic	0.011	0.009	0.008
223	117.920	P12	895	n-Dodecane	0.005	0.005	0.003

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 Mon Aug 30 08:42:11 2004 Page 1

27-Aug-04, 00:17:27
Sample: HUX Tank 31 Operator:
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

Components by Group

Group	Time	Component	%Wgt	%Vol	%Mol
Aromatics	45.127	130 Benzene	0.109	0.093	0.157
	68.463	300 Toluene	3.707	3.191	4.510
	84.220	475 Ethylbenzene	1.024	0.882	1.082
	85.445	500 m-Xylene	2.000	1.728	2.112
	85.583	502 p-Xylene	0.710	0.615	0.749
	88.407	550 o-Xylene	1.178	0.999	1.243
	92.577	616 Isopropylbenzene	0.130	0.113	0.122
	96.014	651 Propylbenzene	0.470	0.407	0.438
	96.860	655 1-Ethyl-3-methylbenzene	0.733	0.632	0.683
	97.093	656 1-Ethyl-4-methylbenzene	0.417	0.362	0.389
	97.703	658 1,3,5-Trimethylbenzene	0.604	0.521	0.564
	98.783	663 1-Ethyl-2-methylbenzene	0.332	0.280	0.309
	100.404	673 1,2,4-Trimethylbenzene	0.750	0.639	0.700
	101.815	690 Isobutylbenzene	0.046	0.040	0.039
	103.257	705 1,2,3-Trimethylbenzene	0.276	0.230	0.257
	103.531	706 1-M-3-isopropylbenzene	0.016	0.014	0.014
	103.688	708 1-M-4-isopropylbenzene	0.039	0.034	0.033
	104.426	712 2,3-Dihydroindene	0.169	0.131	0.160
	105.990	724 1,3-Diethylbenzene	0.051	0.044	0.043
	106.244	725 1-M-3-propylbenzene	0.197	0.170	0.164
	106.432	726 1,4-Diethylbenzene	0.019	0.016	0.016
	106.604	727 1-M-4-propylbenzene	0.059	0.051	0.049
	106.710	728 Butylbenzene	0.061	0.053	0.051
	106.836	729 3,5-DM-1-Ebenzene	0.067	0.058	0.056
	107.116	730 1,2-Diethylbenzene?	0.029	0.025	0.024
	107.560	736 C10-Aromatic	0.033	0.028	0.028
	107.670	738 C10-Aromatic	0.087	0.075	0.073
	107.823	740 1-M-2-propyl benzene	0.064	0.054	0.053
	108.528	756 1,4-DM-2-Ebenzene	0.059	0.050	0.049
	108.691	758 1,3-DM-4-Ebenzene	0.053	0.045	0.044
	109.198	764 1,2-DM-4-Ebenz+C1indan	0.068	0.058	0.057
	109.747	768 1,3-DM-2-Ebenzene	0.029	0.024	0.024
	110.732	780 1-M-4-tert-butylbenzene	0.021	0.018	0.016
	110.857	785 1,2-DM-3-ethylbenzene	0.024	0.020	0.020
	111.367	802 1-E-4-isopropylbenzene	0.020	0.018	0.015
	111.800	806 1,2,4,5-TetraMbenzene	0.011	0.009	0.009
	112.062	810 1,2,3,5-TetraMbenzene	0.020	0.017	0.017
	112.634	816 C11-Aromatic	0.009	0.007	0.006
	113.375	826 1-Ethyl-2-propylbenzene	0.012	0.010	0.009
	113.916	832 C11-Aromatic	0.004	0.004	0.003
	114.126	834 1-Methyl-3-butylbenzene	0.012	0.010	0.009
	114.386	836 1,2,3,4-TetraMbz+C11aro	0.010	0.009	0.009

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 3

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI.FLG

27-Aug-04, 00:17:27
Operator:

Components by Group

Group	Time		Component	%Wgt	%Vol	%Mol
I-Paraffins	87.814	530	3-Methyloctane	1.431	1.473	1.250
	89.684	572	C9-Isoparaffin	0.427	0.435	0.373
	91.096	595	C9-Isoparaffin	0.019	0.019	0.016
	93.819	630	2,2-Dimethyloctane	0.128	0.131	0.101
	94.694	638	2,6-Dimethyloctane	0.097	0.100	0.077
	94.847	640	2,5-Dimethyloctane?	0.109	0.110	0.086
	95.399	646	3,6-Dimethyloctane	0.730	0.737	0.575
	96.232	652	3,6-Dimethyloctane	0.449	0.455	0.354
	96.471	653	3-Methyl-5-ethylheptane	0.074	0.074	0.058
	97.974	659	2,3-Dimethyloctane	0.055	0.055	0.043
	98.212	660	5-Methylnonane	0.231	0.235	0.182
	98.402	661	4-Methylnonane	0.556	0.563	0.438
	98.676	662	2-Methylnonane	0.492	0.504	0.387
	99.375	668	3-Methylnonane	0.480	0.489	0.378
	100.159	672	C10-Isoparaffin	0.051	0.052	0.040
	100.749	674	C10-Isoparaffin	0.202	0.205	0.159
	100.899	675	C10-Isoparaffin	0.176	0.179	0.138
	101.052	676	Isobutylcyclohexane	0.075	0.070	0.059
	101.492	678	C10-Isoparaffin	0.031	0.032	0.025
	101.616	682	C10-Isoparaffin	0.009	0.009	0.007
	102.017	694	C10-Isoparaffin	0.077	0.078	0.061
	102.602	702	C11-Isoparaffin	0.019	0.019	0.013
	103.062	704	C11-Isoparaffin	0.025	0.025	0.018
	103.871	709	C11-Isoparaffin	0.085	0.086	0.061
	104.089	710	C11-Isoparaffin?	0.012	0.012	0.009
	105.219	720	3-Ethylnonane	0.061	0.062	0.044
	105.330	721	C11-Isoparaffin	0.038	0.039	0.028
	105.802	723	C11-Isoparaffin	0.122	0.122	0.109
	107.371	732	C11-Isoparaffin	0.031	0.031	0.022
	108.091	748	4-Methyldecane	0.059	0.055	0.042
	108.392	754	C11-Isoparaffin	0.065	0.061	0.047
	108.819	762	3-Methyldecane	0.016	0.016	0.011
	109.391	766	C11-Isoparaffin	0.010	0.010	0.007
	110.178	770	C11-Isoparaffin	0.018	0.017	0.013
	110.511	775	C11-Isoparaffin	0.015	0.014	0.011
	112.402	812	C12-Isoparaffin	0.009	0.009	0.006
Naphthenes	40.146	112	McyC5+2,2DMC5	0.679	0.676	0.904
	46.992	136	Cyclohexane	0.504	0.483	0.671
	52.814	172	t-1,3-DimethylcyC5	1.487	1.472	1.698
	53.391	174	c-1,3-DMcyclopentane	1.349	1.344	1.540
	54.007	176	t-1,2-DimethylcycloC5	1.632	1.621	1.863

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 2

27-Aug-04, 00:17:27
Sample: HUX Tank 31
Operator:
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

Components by Group

Group	Time	Component	%Wgt	%Vol	%Mol
Aromatics	114.894	842 C11-Aromatic	0.011	0.009	0.008
I-Paraffins	27.947	64 2,3-Dimethylbutane	0.008	0.009	0.010
	29.002	74 2-Methylpentane	0.065	0.075	0.085
	31.636	80 3-Methylpentane	0.086	0.096	0.111
	41.766	116 2,4-Dimethylpentane	0.143	0.158	0.160
	46.727	134 33DMC5+5m1C8ene	0.046	0.050	0.052
	50.190	156 2-MethylC6 + C7-Olefin	4.159	4.571	4.652
	52.019	166 3-Methylhexane	3.284	3.572	3.673
	54.168	180 3-Ethylpentane	0.244	0.260	0.273
	54.624	186 2,2,4-Trimethylpentane	0.040	0.043	0.039
	62.330	226 2,2-Dimethylhexane	0.062	0.066	0.061
	64.404	240 2,2,3-Trimethylpentane	0.011	0.012	0.011
	64.637	245 2,5-DMC6 + C8-olefin	0.504	0.539	0.494
	64.970	250 2,4-Dimethylhexane	0.594	0.633	0.583
	66.207	265 3,3-DMC6 + C8-olefin	0.078	0.081	0.076
	67.933	292 2,3,4-Trimethylpentane	0.067	0.069	0.065
	70.283	314 2,3-Dimethylhexane	0.397	0.416	0.390
	70.428	316 2-M-3-Epentane	0.159	0.166	0.157
	71.621	326 2-Methylheptane	3.088	3.301	3.030
	71.845	328 4-Methylheptane	1.026	1.062	1.007
	72.903	336 3-Methylheptane	2.529	2.673	2.482
	73.052	338 3-Ethylhexane	1.226	1.281	1.203
	79.045	418 2,2,4-Trimethylhexane	0.024	0.025	0.021
	79.913	424 2,3,5-Trimethylhexane	0.049	0.051	0.043
	80.445	428 2,2,3,4-TetraMC5	0.056	0.057	0.049
	81.055	434 2,4-Dimethylheptane	0.420	0.439	0.367
	81.862	444 2-Methyl-4-Ethylhexane	0.056	0.058	0.049
	82.017	446 2,6-Dimethylheptane	0.829	0.859	0.724
	82.940	458 2,5 & 3,5-DMheptane	0.718	0.739	0.628
	83.230	462 3,3-Dimethylheptane	0.207	0.214	0.181
	83.633	466 C9-Isoparaffin	0.218	0.223	0.190
	84.624	485 2,3,4-Trimethylhexane	0.625	0.631	0.546
	85.163	495 3,3,4-Trimethylhexane?	0.153	0.153	0.134
	85.750	503 2,3-Dimethylheptane	0.518	0.530	0.453
	85.998	506 3,4-Dimethylheptane	0.064	0.066	0.056
	86.387	510 3-Methyl-3-ethylhexane	0.246	0.248	0.215
	86.552	516 4-Ethylheptane	0.101	0.104	0.089
	86.814	518 4-MC8+C9-Olefin	0.884	0.916	0.773
	86.954	520 2-Methyloctane	1.215	1.275	1.061
	87.318	524 C9-Isoparaffin	0.139	0.144	0.122
	87.644	528 3-Ethylheptane	0.371	0.379	0.324

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)

Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 3

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI.FLG

27-Aug-04, 00:17:27
Operator:

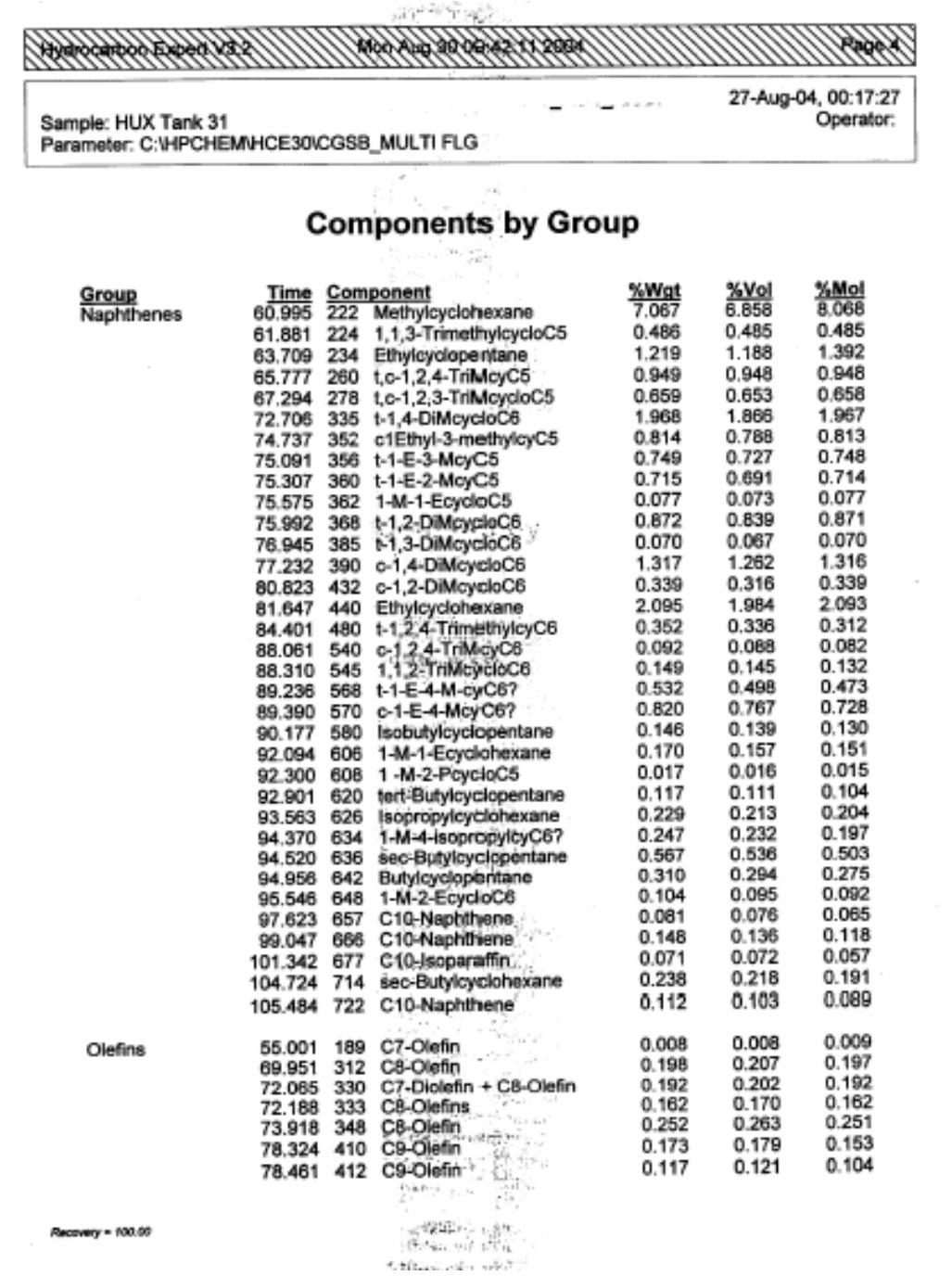
Components by Group

Group	Time		Component	%Wgt	%Vol	%Mol
I-Paraffins	87.814	530	3-Methyloctane	1.431	1.473	1.250
	89.684	572	C9-Isoparaffin	0.427	0.435	0.373
	91.096	595	C9-Isoparaffin	0.019	0.019	0.016
	93.819	630	2,2-Dimethyloctane	0.128	0.131	0.101
	94.694	638	2,6-Dimethyloctane	0.097	0.100	0.077
	94.847	640	2,5-Dimethyloctane?	0.109	0.110	0.086
	95.399	646	3,6-Dimethyloctane	0.730	0.737	0.575
	96.232	652	3,6-Dimethyloctane	0.449	0.455	0.354
	96.471	653	3-Methyl-5-ethylheptane	0.074	0.074	0.058
	97.974	659	2,3-Dimethyloctane	0.055	0.055	0.043
	98.212	660	5-Methylnonane	0.231	0.235	0.182
	98.402	661	4-Methylnonane	0.556	0.563	0.438
	98.676	662	2-Methylnonane	0.492	0.504	0.387
	99.375	668	3-Methylnonane	0.480	0.489	0.378
	100.159	672	C10-Isoparaffin	0.051	0.052	0.040
	100.749	674	C10-Isoparaffin	0.202	0.205	0.159
	100.899	675	C10-Isoparaffin	0.176	0.179	0.138
	101.052	676	Isobutylcyclohexane	0.075	0.070	0.059
	101.492	678	C10-Isoparaffin	0.031	0.032	0.025
	101.616	682	C10-Isoparaffin	0.009	0.009	0.007
	102.017	694	C10-Isoparaffin	0.077	0.078	0.061
	102.602	702	C11-Isoparaffin	0.019	0.019	0.013
	103.062	704	C11-Isoparaffin	0.025	0.025	0.018
	103.871	709	C11-Isoparaffin	0.085	0.086	0.061
	104.089	710	C11-Isoparaffin?	0.012	0.012	0.009
	105.219	720	3-Ethylnonane	0.061	0.062	0.044
	105.330	721	C11-Isoparaffin	0.038	0.039	0.028
	105.802	723	C11-Isoparaffin	0.122	0.122	0.109
	107.371	732	C11-Isoparaffin	0.031	0.031	0.022
	108.091	748	4-Methyldecane	0.059	0.055	0.042
	108.392	754	C11-Isoparaffin	0.065	0.061	0.047
	108.819	762	3-Methyldecane	0.016	0.016	0.011
	109.391	766	C11-Isoparaffin	0.010	0.010	0.007
	110.178	770	C11-Isoparaffin	0.018	0.017	0.013
	110.511	775	C11-Isoparaffin	0.015	0.014	0.011
	112.402	812	C12-Isoparaffin	0.009	0.009	0.006
Naphthenes	40.146	112	MCyC5+2,2DMC5	0.679	0.676	0.904
	46.992	136	Cyclohexane	0.504	0.483	0.671
	52.814	172	t-1,3-DimethylcyC5	1.487	1.472	1.698
	53.391	174	c-1,3-DMcyclopentane	1.349	1.344	1.540
	54.007	176	t-1,2-DimethylcycloC5	1.632	1.621	1.863

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 4

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

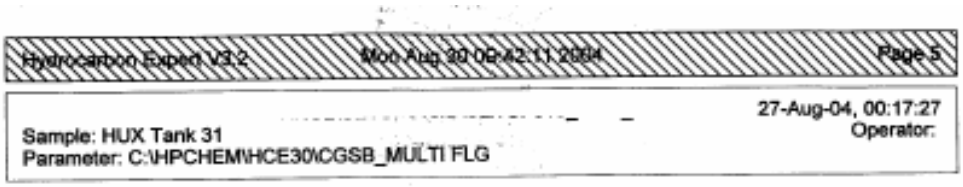
Components by Group

Group	Time		Component	%Wgt	%Vol	%Mol
Naphthenes	60.995	222	Methylcyclohexane	7.067	6.858	8.068
	61.881	224	1,1,3-TrimethylcycloC5	0.486	0.485	0.485
	63.709	234	Ethylcyclopentane	1.219	1.188	1.392
	65.777	260	t,c-1,2,4-TriMcyC5	0.949	0.948	0.948
	67.294	278	t,c-1,2,3-TriMcycloC5	0.659	0.653	0.658
	72.706	335	t-1,4-DiMcycloC6	1.968	1.866	1.967
	74.737	352	c1Ethyl-3-methylcyC5	0.814	0.788	0.813
	75.091	356	t-1-E-3-McyC5	0.749	0.727	0.748
	75.307	360	t-1-E-2-McyC5	0.715	0.691	0.714
	75.575	362	1-M-1-EcycloC5	0.077	0.073	0.077
	75.992	368	t-1,2-DiMcycloC6	0.872	0.839	0.871
	76.945	385	t-1,3-DiMcycloC6	0.070	0.067	0.070
	77.232	390	c-1,4-DiMcycloC6	1.317	1.262	1.316
	80.823	432	c-1,2-DiMcycloC6	0.339	0.316	0.339
	81.647	440	Ethylcyclohexane	2.095	1.984	2.093
	84.401	480	t-1,2,4-TrimethylcyC6	0.352	0.336	0.312
	88.061	540	c-1,2,4-TriMcyC6	0.092	0.088	0.082
	88.310	545	1,1,2-TriMcycloC6	0.149	0.145	0.132
	89.236	568	t-1-E-4-M-cyC6?	0.532	0.498	0.473
	89.390	570	c-1-E-4-McyC6?	0.820	0.767	0.728
	90.177	580	Isobutylcyclopentane	0.146	0.139	0.130
	92.094	606	1-M-1-Ecyclohexane	0.170	0.157	0.151
	92.300	608	1 -M-2-PcycloC5	0.017	0.016	0.015
	92.901	620	tert-Butylcyclopentane	0.117	0.111	0.104
	93.563	626	Isopropylcyclohexane	0.229	0.213	0.204
	94.370	634	1-M-4-IsopropylcyC6?	0.247	0.232	0.197
	94.520	636	sec-Butylcyclopentane	0.567	0.536	0.503
	94.956	642	Butylcyclopentane	0.310	0.294	0.275
	95.546	648	1-M-2-EcycloC6	0.104	0.095	0.092
	97.623	657	C10-Naphthene	0.081	0.076	0.065
	99.047	666	C10-Naphthene	0.148	0.136	0.118
	101.342	677	C10-Isoparaffin	0.071	0.072	0.057
	104.724	714	sec-Butylcyclohexane	0.238	0.218	0.191
	105.484	722	C10-Naphthene	0.112	0.103	0.089
Olefins	55.001	189	C7-Olefin	0.008	0.008	0.009
	69.951	312	C8-Olefin	0.198	0.207	0.197
	72.065	330	C7-Diolefin + C8-Olefin	0.192	0.202	0.192
	72.188	333	C8-Olefins	0.162	0.170	0.162
	73.918	348	C8-Olefin	0.252	0.263	0.251
	78.324	410	C9-Olefin	0.173	0.179	0.153
	78.461	412	C9-Olefin	0.117	0.121	0.104

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



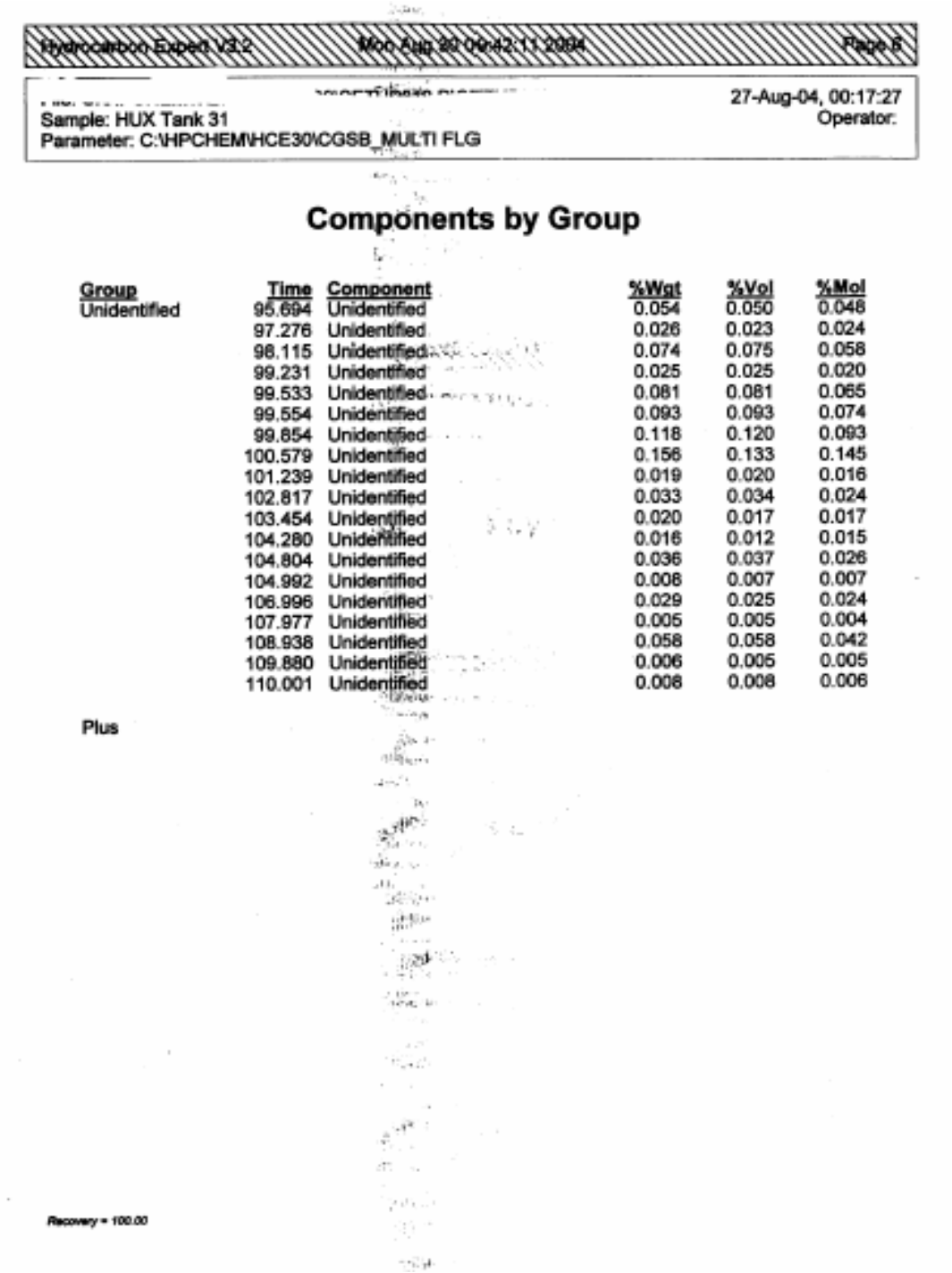
Components by Group

Group	Time	Component	%Wgt	%Vol	%Mol
Olefins	79.980	426 cis-2-Octene	0.249	0.256	0.248
	81.333	436 C9-Olefin	0.070	0.072	0.062
	82.179	449 C9-Olefin	0.131	0.135	0.117
	82.450	452 C9-Olefins	0.941	0.967	0.836
	82.793	454 C9-Olefins	0.171	0.176	0.152
	83.106	460 C9-Olefins	0.122	0.126	0.109
	84.885	490 C9-Olefins	0.087	0.089	0.077
	86.189	508 C9-Olefin	0.150	0.154	0.134
	87.888	535 C9-Olefin	0.137	0.139	0.121
	88.539	560 C9-Olefin	0.089	0.090	0.079
	88.658	562 C9-Olefin	0.151	0.154	0.134
	88.869	564 C9-Olefin	0.021	0.021	0.018
	90.006	575 1-Nonene	0.099	0.101	0.088
	90.965	590 cis-3-Nonene	0.066	0.067	0.058
	91.746	604 trans-2-Nonene	0.511	0.516	0.453
	92.830	618 cis-2-Nonene	0.029	0.030	0.026
	93.051	622 C9-Olefins	0.316	0.320	0.281
	93.288	624 C9-Olefin	0.249	0.252	0.221
	95.825	650 C10-Olefin	0.133	0.134	0.107
	96.607	654 C10-Olefin	0.100	0.101	0.080
	99.705	670 C10-Olefin	0.041	0.042	0.033
Paraffin	35.357	96 n-Hexane	0.183	0.207	0.239
	57.634	200 n-Heptane	6.727	7.339	7.525
	77.480	400 n-Octane	5.571	5.913	5.466
	91.328	600 n-Nonane	4.325	4.495	3.780
	102.309	700 n-Decane	1.893	1.935	1.491
	111.189	800 n-Undecane	0.154	0.155	0.110
	117.920	895 n-Dodecane	0.005	0.005	0.003
Oxygenates					
Unidentified	79.375	Unidentified	0.053	0.055	0.046
	83.405	Unidentified	0.332	0.344	0.290
	86.133	Unidentified	0.067	0.069	0.060
	87.260	Unidentified	0.033	0.035	0.029
	88.945	Unidentified	0.021	0.021	0.019
	90.262	Unidentified	0.069	0.066	0.062
	90.329	Unidentified	0.015	0.015	0.014
	93.970	Unidentified	0.021	0.021	0.016
	94.069	Unidentified	0.016	0.017	0.013
	94.290	Unidentified	0.102	0.096	0.082
	95.143	Unidentified	0.099	0.093	0.088

Recovery = 100.00

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



Hydrocarbon Expert V3.2 — Mon Aug 30 09:42:11 2004 — Page 6

Sample: HUX Tank 31
Parameter: C:\HPCHEM\HCE30\CGSB_MULTI FLG

27-Aug-04, 00:17:27
Operator:

Components by Group

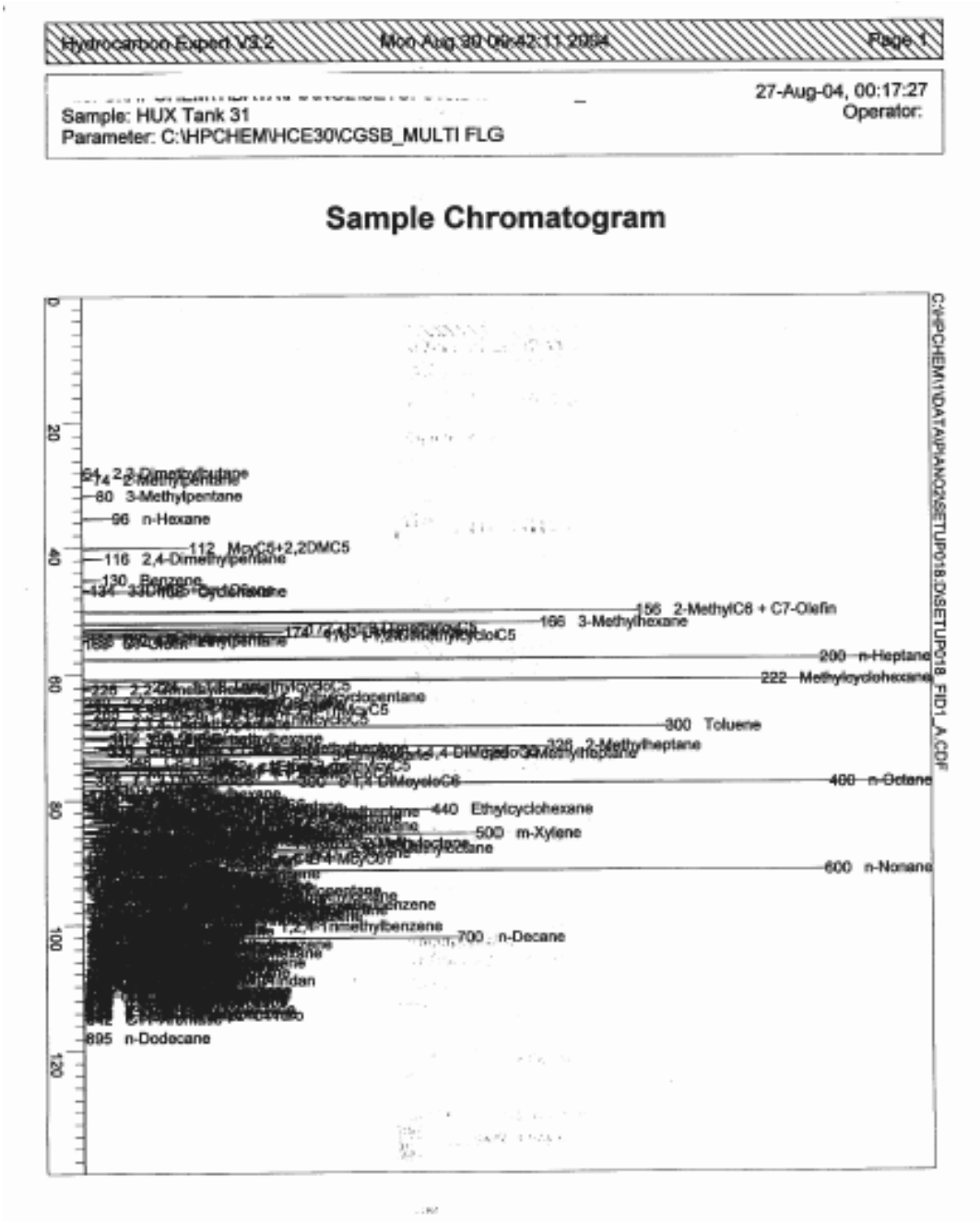
Group	Time	Component	%Wgt	%Vol	%Mol
Unidentified	95.694	Unidentified	0.054	0.050	0.048
	97.276	Unidentified	0.026	0.023	0.024
	98.115	Unidentified	0.074	0.075	0.058
	99.231	Unidentified	0.025	0.025	0.020
	99.533	Unidentified	0.081	0.081	0.065
	99.554	Unidentified	0.093	0.093	0.074
	99.854	Unidentified	0.118	0.120	0.093
	100.579	Unidentified	0.156	0.133	0.145
	101.239	Unidentified	0.019	0.020	0.016
	102.817	Unidentified	0.033	0.034	0.024
	103.454	Unidentified	0.020	0.017	0.017
	104.280	Unidentified	0.016	0.012	0.015
	104.804	Unidentified	0.036	0.037	0.026
	104.992	Unidentified	0.008	0.007	0.007
	106.996	Unidentified	0.029	0.025	0.024
	107.977	Unidentified	0.005	0.005	0.004
	108.938	Unidentified	0.058	0.058	0.042
	109.880	Unidentified	0.006	0.005	0.005
	110.001	Unidentified	0.008	0.008	0.006

Plus

Recovery = 100.00

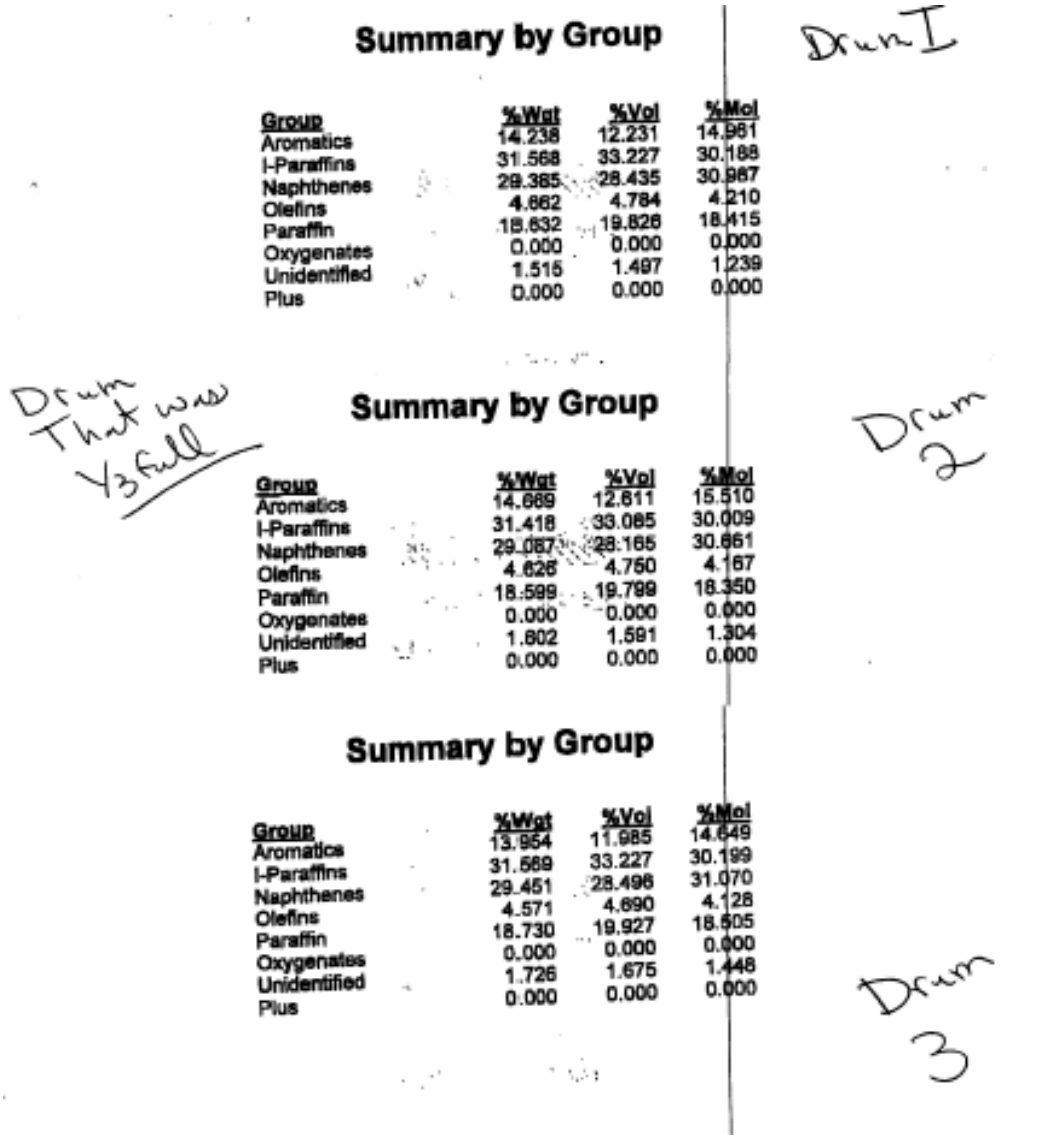
APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

1. Detailed Hydrocarbon Analyses – Refinery Sample (Cont'd)



APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

2. Detailed Hydrocarbon Analyses – Comparison of Three Sample Drums



Summary by Group — Drum I

Group	%Wgt	%Vol	%Mol
Aromatics	14.238	12.231	14.961
I-Paraffins	31.568	33.227	30.188
Naphthenes	29.385	28.435	30.967
Olefins	4.662	4.784	4.210
Paraffin	18.632	19.826	18.415
Oxygenates	0.000	0.000	0.000
Unidentified	1.515	1.497	1.239
Plus	0.000	0.000	0.000

Drum That was Y3 full

Summary by Group — Drum 2

Group	%Wgt	%Vol	%Mol
Aromatics	14.669	12.611	15.510
I-Paraffins	31.418	33.085	30.009
Naphthenes	29.087	28.165	30.661
Olefins	4.626	4.750	4.167
Paraffin	18.599	19.799	18.350
Oxygenates	0.000	0.000	0.000
Unidentified	1.802	1.591	1.304
Plus	0.000	0.000	0.000

Summary by Group — Drum 3

Group	%Wgt	%Vol	%Mol
Aromatics	13.954	11.985	14.649
I-Paraffins	31.569	33.227	30.199
Naphthenes	29.451	28.496	31.070
Olefins	4.571	4.690	4.128
Paraffin	18.730	19.927	18.505
Oxygenates	0.000	0.000	0.000
Unidentified	1.726	1.675	1.448
Plus	0.000	0.000	0.000

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

3. Intertek Caleb Brett Sample, Physical–Chemical Analyses

Intertek Caleb Brett

Intertek Caleb Brett
1114 Seaco Avenue
Deer Park, TX 77536
Ph: (713) 844 3200
Fax: (713) 844-3330
Email: dptechstr@intertek.com

Report of Analysis No. 2005-001447-DRPK

SAMPLE DETAILS: Sample(s) received on Tuesday, March 22, 2005

SUBMITTED BY: API, Regulatory Affairs and Scientific Affairs

CUSTOMER PRODUCT DESCRIPTION
ID: Highly Naphthenic Nagtha

SAMPLE ID
2005-001447-DRPK-001

RESULTS: SEE ATTACHED SHEETS

APPROVED BY: [redacted]
Intertek Caleb Brett

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

3. Intertek Caleb Brett Sample, Physical–Chemical Analyses (Cont'd)

Intertek Caleb Brett

Report of Analysis No. 2005-001447-DRPK

Page 2 of 3

Sample ID : 2005-001447-DRPK-001

Customer Product Description : ID: Highly Naphthenic Naptha

Method	Test	Results	Units
ASTM D1319 (IP 156)	Aromatics	10.1	Vol %
ASTM D1319 (IP 156)	Olefins	0.6	Vol %
ASTM D1319 (IP 156)	Saturates	89.3	Vol %
ASTM D2386	Freezing Point	<-72.0	
ASTM D2386	Freezing Point	<-97.6	°F
ASTM D4052 (IP 365)	API Gravity 15.56°C, 60°F	56.1	°API
ASTM D445 (IP 71S1)	Kinematic Viscosity at 40°C, 104°F	0.6433	cSt
ASTM D4629 (IP 379)	Nitrogen	0.6	ppm (mg / kg)
ASTM D6191-EPA	Dry Vapor Pressure Equivalent	1.43	psi
ASTM D6191-EPA	Sample	Normal	
ASTM D6443	Iso-Paraffins	28.52	Vol %
ASTM D6443	n-Paraffins	19.88	Vol %
ASTM D6443	Olefins	0.67	Vol %
ASTM D6443	Naphthenes	39.59	Vol %
ASTM D6443	Aromatics	11.12	Vol %
ASTM D6443	> 200 °C (Non Aromatic)	0.22	Vol %
ASTM D5453	Sulfur	2.1	ppm (µg / g)
ASTM D6730	Paraffins	20.33	Vol %
ASTM D6730	Iso-Paraffins	31.68	Vol %
ASTM D6730	Olefins	1.86	Vol %
ASTM D6730	Naphthenes	32.32	Vol %
ASTM D6730	Aromatics	12.25	Vol %
ASTM D6730	C14+	<0.01	Vol %
ASTM D6730	Unknowns	1.56	Vol %
ASTM D6730	N+A	44.57	Vol %
ASTM D6730	Molecular Weight	112.25	
ASTM D86	Initial Boiling Point	209.8	°F
ASTM D86	5% Recovery	225.9	°F
ASTM D86	10% Recovery	229.0	°F
ASTM D86	20% Recovery	233.5	°F
ASTM D86	30% Recovery	238.4	°F
ASTM D86	40% Recovery	244.8	°F
ASTM D86	50% Recovery	251.7	°F
ASTM D86	60% Recovery	260.7	°F

Initial: [redacted]

Intertek Caleb Brett, 1114 Seaco Avenue, Deer Park TX 77536, Ph: (713) 844-3200, Fax: (713) 844-3330, Email: dptechctr@intertek.com

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

3. Intertek Caleb Brett Sample, Physical–Chemical Analyses (Cont'd)

Intertek Caleb Brett **Report of Analysis No.** 2005-001447-DRPK

Page 3 of 3

Sample ID : 2005-001447-DRPK-001
Customer Product Description : ID: Highly Naphthenic Naptha

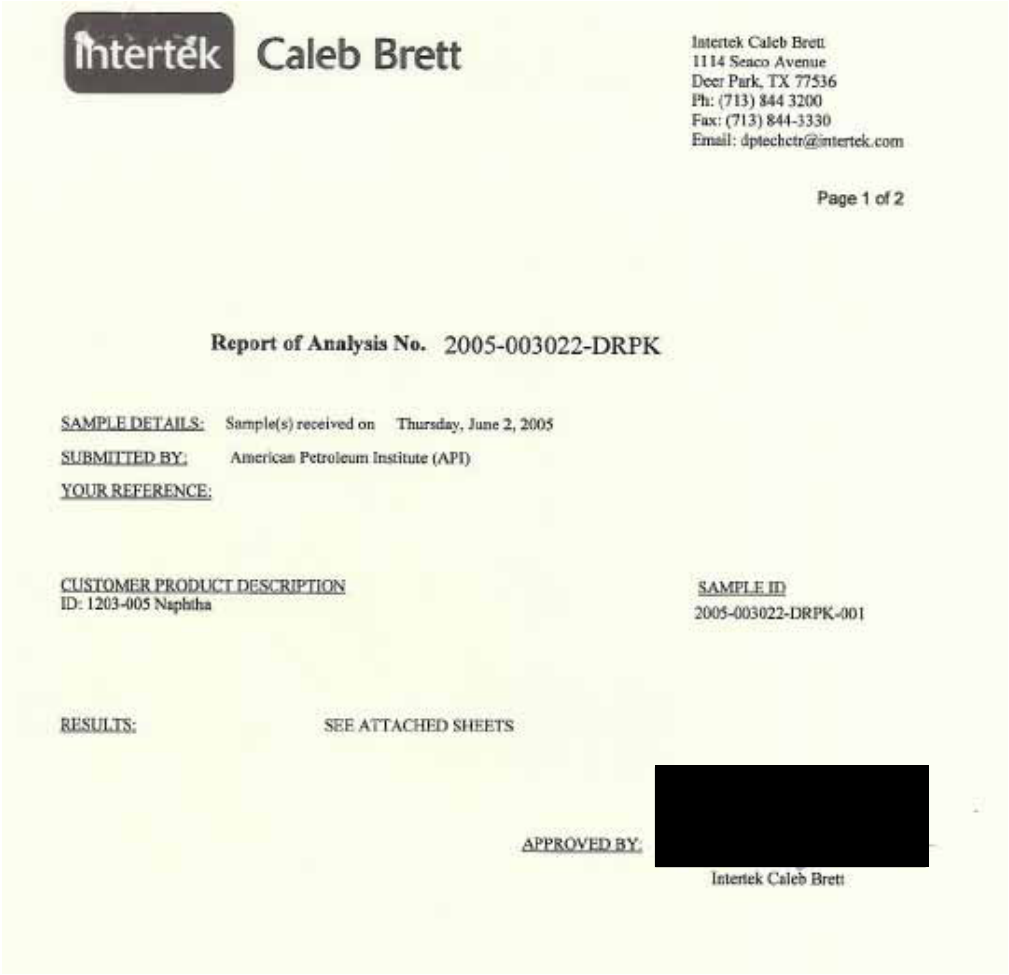
Method	Test	Results	Units
ASTM D86	70% Recovery	272.1	°F
ASTM D86	80% Recovery	285.5	°F
ASTM D86	90% Recovery	303.1	°F
ASTM D86	95% Recovery	315.9	°F
ASTM D86	Final Boiling Point	352.2	°F
ASTM D86	% Recovered	100.0	Vol %
ASTM D86	% Residue	0.0	Vol %
ASTM D86	% Loss	0.0	Vol %

Initial: [redacted]

Intertek Caleb Brett, 1114 Seaco Avenue, Deer Park TX 77536, Ph: (713) 844-3200, Fax: (713) 844-3330, Email: dpteducts@intertek.com

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

4. Intertek Caleb Brett Reid Vapor Pressure Analysis



Intertek Caleb Brett

Intertek Caleb Brett
1114 Seaco Avenue
Deer Park, TX 77536
Ph: (713) 844 3200
Fax: (713) 844-3330
Email: dptechctr@intertek.com

Page 1 of 2

Report of Analysis No. 2005-003022-DRPK

SAMPLE DETAILS: Sample(s) received on Thursday, June 2, 2005

SUBMITTED BY: American Petroleum Institute (API)

YOUR REFERENCE:

CUSTOMER PRODUCT DESCRIPTION
ID: 1203-005 Naphtha

SAMPLE ID
2005-003022-DRPK-001

RESULTS: SEE ATTACHED SHEETS

APPROVED BY: [redacted]
Intertek Caleb Brett

APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL–CHEMICAL CHARACTERIZATION DATA (CONT'D)

4. Intertek Caleb Brett Reid Vapor Pressure Analysis (Cont'd)

Intertek Caleb Brett **Report of Analysis No.** 2005-003022-DRPK

Page 2 of 2

Sample ID : 2005-003022-DRPK-001

Customer Product Description : ID: 1203-005 Naphtha

Method	Test	Results	Units
ASTM D323 Procedure A	Reid Vapor Pressure	0.00	psi

Initial: [redacted]

Intertek Caleb Brett, 1114 Seaco Avenue, Deer Park TX 77536, Ph: (713) 844-3200, Fax: (713) 844-3330, Email: dptechctr@intertek.com

APPENDIX H – SAMPLE CHARACTERIZATION OF HIGH NAPHTHENIC NAPHTHA: CHEMICAL ABSTRACT NUMBER DESIGNATION

The test material used in studies to characterize mammalian toxicity and biodegradation of hydrocarbons in the Naphthenic (cycloparaffin) blending streams category of the HPV Gasoline Blending Stream Test Plan is a high naphthenic naphtha containing approximately 30% naphthenes. Results of studies with this test material can be used for read-across purposes for all CAS numbers identifying high naphthenic gasoline blending streams containing 19 to 30% or more naphthenic components.

This high naphthenic naphtha is derived from hydrogenation and hydrocracking process steps with removal of nitrogen and sulfur (sweetening) that convert low grade gas oils to higher quality components for direct blending of gasoline. Due to the multiple steps in generating this test material, the supplying refinery identified the sample under the broad CAS #64741-41-9, with the Chemical Abstract name of Naphtha, petroleum, heavy straight run, a CAS number which encompasses the more process-specific designations sweet naphtha and heavy crackate. The refinery further indicated that the sample underwent the hydrocracking HUX process that also makes applicable the more narrowly defined designation heavy hydrocrackate. Finally, the CAS #64741-78-2, with the Chemical Abstract name of Naphtha, petroleum, heavy hydrocracked can and has been used to identify this test material and is descriptive of the hydrocracking step employed.

This test sample identified as CAS #64741-41-9 for chain of custody purposes was collected as a single lot from one refinery and was chemically characterized prior to shipping in 3 drums to the sample repository. Contents of each drum were further analyzed to verify compositional uniformity between drums and distributed to the contract laboratories for testing. CAS #64741-41-9 and the name Naphtha, petroleum, heavy straight run will therefore be used officially to designate the test material.

Revision 1: November 18, 2008

APPENDIX I – REPORT REVISION

The final report for Study 0545979 was revised at the request of the sponsor as follows:

Page 1 – Document number
PREVIOUS: 07TP 3
REVISION: 08TP 11
REASON FOR CHANGE: New document number generated as result of report revision, original document number supplanted.

Page 2 – TABLE OF CONTENTS
REVISION: Appendix H - Sample Characterization of High Naphthenic Naphtha: Chemical Abstract Number Designation……..69
REASON FOR CHANGE: Table of Contents updated with additional information supplied by sponsor.

Page 4 – QUALITY ASSURANCE STATEMENT
REVISION: Report Revision 1 added.
REASON FOR CHANGE: QA statement updated to reflect review of revisions.

Page 9 – Test Substance Identification
PREVIOUS: Sponsor Identification: High Naphthenic, Heavy, Straight-Run Naphtha
REVISION: Sponsor Identification: High Naphthenic, Heavy, Straight-Run Naphtha*
* An explanation of the Chemical Abstract Service (CAS) number designation for this test sample is provided in Appendix H.
REASON FOR CHANGE: Footnote added, refers to additional information supplied by sponsor.

Page 46 – APPENDIX G - PRE-TEST COMPOSITIONAL ANALYSES AND SAMPLE PHYSICAL─CHEMICAL CHARACTERIZATION DATA
PREVIOUS: The chemical analyses ….. high naphthenic naphtha (CAS Number 64741-78-2).
REVISION: The chemical analyses ……. high naphthenic naphtha (CAS Number 64741-78-2)*.
* An explanation of the Chemical Abstract Service (CAS) number designation for this test sample is provided in Appendix H.
REASON FOR CHANGE: Report updated with additional information supplied by sponsor.

Page 69 – APPENDIX H – SAMPLE CHARACTERIZATION OF HIGH NAPHTHENIC NAPHTHA: CHEMICAL ABSTRACT NUMBER DESIGNATION
REVISION: Additional Appendix added.
REASON FOR CHANGE: Report updated with additional information supplied by sponsor.

Page 70 – APPENDIX I – REPORT REVISION
REVISION: Additional Appendix added.
REASON FOR CHANGE: Report updated with details for report revision.

[redacted]

25 NOV 08
Date

Revision 1: November 18, 2008