January 11, 2005

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Mr. Charlie Auer
Director
TSCA Document Control Office (7407)
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Office of Pollution Prevention and Toxics
U.S. Environmental Protection Agency
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Washington, DC 20460-0001

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Dear Mr. Auer:

The American Chemistry Council makes available to the public and appropriate government agencies final reports of environmental, health, and safety research that it manages. In keeping with this policy, the following reports that the American Chemistry Council's Olefins Panel recently conducted are enclosed:

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"*Daphnia sp.*, Acute Immobilization Test on Heavy Pyrolysis Fuel Oil,"

"Fish, Acute Toxicity Test on Heavy Pyrolysis Fuel Oil,"

"Alga, Growth Inhibition Test on Heavy Pyrolysis Fuel Oil,"

"Ready Biodegradability: OECD 301F Manometric Respirometry Test on Heavy Pyrolysis Fuel Oil,"

"*Daphnia sp.*, Acute Immobilization Test on Pyrolysis C10+ Fuel Oil (From Pyrolysis Gasoline Distillation),"

"Fish, Acute, Toxicity Test on Pyrolysis C10+ Fuel Oil (From Pyrolysis Gasoline Distillation),"

"Alga, Growth Inhibition Test on Pyrolysis C10+ Fuel Oil (From Pyrolysis Gasoline Distillation)," and

"Ready Biodegradability: OECD 301F Manometric Respirometry Test on Pyrolysis C10+ Fuel Oil (From Pyrolysis Gasoline Distillation)."

The enclosed reports do not include confidential information.

If you have any questions, please call the Olefins Panel Manager of my staff at 301-924-2006.

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Sincerely yours,

Enclosure

**Robust Summary**
**Invertebrate Acute Toxicity**

| | |
|---|---|
| **Test Substance:** | Industry Stream Name (acronym): Heavy Pyrolysis Fuel Oil<br>CAS Number: / CAS Inventory Name:<br>68513-69-9 Residues, petroleum, steam-cracked light<br>64741-62-4 Clarified oils, petroleum, catalytic cracked<br>69013-21-4 Fuel oil, pyrolysis<br>8002-05-9 Petroleum<br>In ethylene plants cracking liquid feedstocks, the cracking furnace effluent (after heat recovery) is quenched by injection of recycled quench oil. This step results in the condensation of higher boiling hydrocarbon compounds that are typically separated from the rest of the furnace effluent as the bottoms of the oil quench tower. Lights are stripped from the excess oils generated from this quench system, resulting in the stream identified here as heavy pyrolysis fuel oil. |
| **Method/Guideline:** | OECD Guideline 202 |
| **Year (guideline):** | 1984 |
| **Type (test type):** | Daphnid Acute Toxicity Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Species:** | *Daphnia magna* Straus |
| **Analytical Monitoring:** | Yes |
| **Exposure Period:** | 48 hours |
| **Statistical Method:** | The 24-hour $EL_{50}$ and $EC_{50}$ values were determined using a Trimmed Spearman-Karber Method (Hamilton et al.,1977). A Binomial Method (Stephan, 1977) was used to determine the 48-hour $EL_{50}$ and $EC_{50}$ values.<br>Hamilton, M., R. Russo, R. Thurston, 1977. Trimmed Spearman-Karber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays. *Environmental Science and Technology*, Vol. 11, No. 7, p.714-719.<br>Stephan, C. E., Methods for Calculating an $LC_{50}$, *Aquatic Toxicology and Hazard Evaluation, ASTM STP 634*, F. L. Mayer and J. L. Hamelink, Eds., American Society for Testing and Materials, 1977, pp. 65-84. |
| **Test Conditions:**<br>• **Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.** | Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 4.0 L of reconstituted water in glass aspirator bottles (capacity 4.5 L). The solutions were mixed for 24 hours using a 5% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into four replicates of approximately 140 mL in 125 mL Erlenmeyer flasks (no headspace). Five daphnids were added to each replicate and the replicates were closed. The test was performed under static conditions with no aeration.<br>Mean test temperature: 20.1°C (S.D. = 0.1), diurnal light: approximately 16 hours light and 8 hours dark with 100 to 113 lux during full daylight periods. Dissolved oxygen ranged from 8.0 to 8.6 mg/L and pH ranged from 7.8 to 8.1 during the study. Water hardness was 134 mg/L as $CaCO_3$.<br>The Daphnids were cultured in-house. Age was <24 hours old from 13-day old parents. |

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| | Due to the relatively complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. The initial concentration of the test substance was not maintained at 80% in the lowest loading rate throughout the test, 74% of the initial concentration was maintained. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution. |
| **Results:**<br><br>**Units/Value:**<br><br>**Note: Analytical method, biological observations, control survival.** | Effect Loading ($EL_{50}$) / Effect Concentration ($EC_{50}$) Values (mg/L)<br>$EL_{50}$ $EC_{50}$<br>24 hours 3.7 (3.3-4.2*) 3.0 (2.7-3.4*)<br>48 hours 3.3 (2.3-4.8**) 2.7 (1.8-4.1**)<br>* 95% Confidence Interval<br>** 99% Confidence Interval<br><br>The maximum actual loading rate causing no immobilization after 48-hours was 2.3 mg/L. The minimum actual loading rate causing 100% immobilization after 48 hours was 4.8 mg/L.<br><br>The maximum measured concentration causing no immobilization after 48-hours was 1.8 mg/L. The minimum measured concentration causing 100% immobilization after 48-hours was 4.1 mg/L.<br><br>The method of analysis was gas chromatography with flame ionization detection (HS GC-FID).<br><br>Loading Rate (mg/L) / Measured Conc. (mg/L) / % Immobilization 24-hour / 48-hour<br>Control 0 0 0<br>0.50 0.18 0 0<br>1.0 1.6 0 0<br>2.3 1.8 0 0<br>4.8 4.1 85 100<br>10 7.8 100 100 |
| **Conclusion:** | After *Daphnia magna* were exposed to WAFs prepared from Heavy Pyrolysis Fuel Oil for 48-hours, the $EL_{50}$ was 3.3 mg/L and the $EC_{50}$ was 2.7 mg/L. |
| **Reliability:** | 1-Reliable without restrictions. |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2004. *Daphnia sp.*, ACUTE IMMOBILIZATION TEST on HEAVY PYROLYSIS FUEL OIL. Study # 176842 |
| **Other (source):** | Olefins Panel, American Chemistry Council |

**Robust Summary**
**Fish, Acute Toxicity**

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|---|---|
| **Test Substance:** | Industry Stream Name (acronym): Heavy Pyrolysis Fuel Oil<br>CAS Number: / CAS Inventory Name:<br>68513-69-9 Residues, petroleum, steam-cracked light<br>64741-62-4 Clarified oils, petroleum, catalytic cracked<br>69013-21-4 Fuel oil, pyrolysis<br>8002-05-9 Petroleum<br>In ethylene plants cracking liquid feedstocks, the cracking furnace effluent (after heat recovery) is quenched by injection of recycled quench oil. This step results in the condensation of higher boiling hydrocarbon compounds that are typically separated from the rest of the furnace effluent as the bottoms of the oil quench tower. Lights are stripped from the excess oils generated from this quench system, resulting in the stream identified here as heavy pyrolysis fuel oil. |
| **Method/Guideline:** | OECD Guideline 203 |
| **Year (guideline):** | 1992 |
| **Type (test type):** | Fish Acute Toxicity Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Species:** | *Oncorhynchus mykiss* |
| **Analytical Monitoring:** | Yes |
| **Exposure Period:** | 96 hours |
| **Statistical Method:** | The 24 - 96 hour $LL_{50}$ and $LC_{50}$ values were determined using a Trimmed Spearman-Karber Method (Hamilton et al.,1977).<br>Hamilton, M., R. Russo, R. Thurston, 1977. Trimmed Spearman-Karber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays. *Environmental Science and Technology*, Vol. 11, No. 7, p.714-719. |
| **Test Conditions:**<br>• **Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.** | Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 18 L of reconstituted water in glass aspirator bottles (capacity 22 L). The solutions were mixed for 24 hours using a 3% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into three replicates of approximately 4.5 L in 4 L size aspirator bottles (no headspace). Four fish were added to each replicate and the replicates were closed with foil covered neoprene stoppers. Daily renewals were performed by removing ~90% of the test solution through the outlet at the bottom of the aspirator bottle and refilling with fresh solution. The fish were received from Thomas Fish Company, Anderson, CA. The fish were not fed during the study. They were held for 12 days in study dilution water prior to use and were 36 days old at the start of the study. Fish mean weight = 0.194 g, mean total length = 3.1 cm, test loading = 0.172 g of fish/L.<br>Mean test temperature: 13.6°C (S.D. = 0.1), diurnal light: approximately 16 hours light and 8 hours dark with 644 to 653 Lux during full daylight periods. Dissolved oxygen ranged from 6.7 to 8.5 mg/L and pH ranged from 6.5 to 8.0 during the study. Water hardness was 98 mg/L as $CaCO_3$. |

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| | Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study:<br>The concentration of the test substance in solution was not determined prior to use. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution.<br>The protocol required that the fish would be held at test temperature (13-15°C) for at least 7 days prior to use in the test The fish were held at 12.8°C for the 7 days prior to use in the study. This deviation is not believed to have affected the outcome or integrity of the study. |
| **Results:**<br>**Units/Value:**<br>**Note: Analytical method, biological observations, control survival.** | The maximum actual loading rate causing no mortality after 96-hours was 2.6 mg/L. The maximum measured concentration causing no mortality after 96-hours was 2.5 mg/L. The minimum actual loading rate causing 100% mortality after 96-hours was 11 mg/L. The minimum measured concentration causing 100% mortality after 96-hours was 9.1 mg/L. The method of analysis was gas chromatography with flame ionization detection (GC-FID).<br>Lethal Loading ($LL_{50}$) / Lethal Concentration ($LC_{50}$) Values (mg/L)<br>$LL_{50}$ $LC_{50}$<br>3 & 6 hours >11* >9.1*<br>24 hours 7.5 (6.7-8.4) 5.8 (5.2-6.4)<br>48 hours 5.9 (4.8-7.3) 4.7 (3.9-5.6)<br>72 & 96 hours 5.6 (4.5-6.9) 4.4 (3.7-5.3)<br>* Not a calculated value, no mortality was observed in the highest loading rate/concentration at 3 hours, 42% mortality was observed in the highest loading rate/concentration at 6 hours therefore the EL/$EC_{50}$ is greater than the highest loading rate/concentration tested.<br>Values in parentheses are 95% confidence intervals<br>Summary of In-Life observations - % Mortality<br>Loading Rate (mg/L) Control 0.63 1.4 2.6 5.8 11<br>Meas. Conc. (mg/L) 0 0.30 1.2 2.5 4.1 9.1<br>3 hours 0 0 0 0 0 0<br>6 hours 0 0 0 0 0 42<br>24 hours 0 0 0 0 8 100<br>48 hours 0 0 0 0 42 100<br>72 & 96 hours 0 0 0 0 58 100 |
| **Conclusion:** | After *Oncorhynchus mykiss* were exposed to WAFs prepared from Heavy Pyrolysis Fuel Oil for 96-hours, the $LL_{50}$ was 5.6 mg/L and the $LC_{50}$. was 4.4 mg/L. |
| **Reliability:** | 1-Reliable without restrictions. |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2004. FISH, ACUTE TOXICITY TEST on HEAVY PYROLYSIS FUEL OIL. Study # 176858 |
| **Other (source):** | Olefins Panel, American Chemistry Council |

**Robust Summary**
**Alga Toxicity**

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| **Test Substance:** | Industry Stream Name (acronym): Heavy Pyrolysis Fuel Oil<br>CAS Number: CAS Inventory Name:<br>68513-69-9 Residues, petroleum, steam-cracked light<br>64741-62-4 Clarified oils, petroleum, catalytic cracked<br>69013-21-4 Fuel oil, pyrolysis<br>8002-05-9 Petroleum<br>In ethylene plants cracking liquid feedstocks, the cracking furnace effluent (after heat recovery) is quenched by injection of recycled quench oil. This step results in the condensation of higher boiling hydrocarbon compounds that are typically separated from the rest of the furnace effluent as the bottoms of the oil quench tower. Lights are stripped from the excess oils generated from this quench system, resulting in the stream identified here as heavy pyrolysis fuel oil. |
| **Method/Guideline:** | OECD Guideline 201 |
| **Year (guideline):** | 1984 |
| **Type (test type):** | Alga Toxicity Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Species:** | *Pseudokirchneriella subcapitata* |
| **Analytical Monitoring:** | Yes |
| **Exposure Period:** | 96 hours |
| **Statistical Method:** | The $E_bC_{50}$, $E_rC_{50}$ and confidence intervals for inhibition of growth/growth rate slope were determined by a probit regression calculation of the probit of the growth inhibition/growth rate slope vs the log of the concentration and associated confidence intervals based on the methods of D. J. Finney (Finney, 1971). Calculations were based on the PROC PROBIT procedure of SAS (SAS, 2002). The NOEC for the $E_bC_{50}$ and $E_rC_{50}$ was based on Multiple Range tests (Duncan, 1975) and (Dunnett, 1964), determined from the GLM procedure of SAS (SAS, 2002). The Shapiro-Wilk (Shapiro-Wilk, 1965) test for normality was used to test if the assumption of normality of the residuals was met; since the residuals were normally distributed the NOEC was based on the estimated values.<br>Finney, D.J. 1971. Probit Analysis, 3rd Edition, London: Cambridge University Press.<br>SAS Version 8, SAS Institute, Inc., Cary, NC. 2002.<br>Duncan, D.B. 1975, “t-Tests and Intervals for Comparisons Suggested by the Data”, Biometrics, 31, 339-359.<br>Dunnett, C. 1964, "New Tables for Multiple Comparisons With A Control", Biometrics, Vol 20, No. 3, pg 482-491.<br>Shapiro, S.S. and Wilk, M.B. 1965,“n analysis of variance test for normality (complete samples)” Biometrika, 52, pg 591-611. |

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| **Test Conditions:**<br>• **Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.** | Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 2.0 L of algal nutrient medium augmented with sodium bicarbonate in glass aspirator bottles (capacity 2.3 L). The solutions were mixed for 24.5 hours using an 7% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into 12 replicates of approximately 140 mL in 125 mL Erlenmeyer flasks (no headspace) containing two 14 mm glass spheres to facilitate mixing. The test chambers were inoculated with algae (1.0 x $10^4$ cells/mL) and were sealed with ground glass stoppers. Three replicates were sacrificed daily for cell density determination. The test chambers were placed on a shaker table (100 rpm) to keep the algae in suspension. The test was performed under static conditions with no aeration. The algae was cultured in-house from 5 day old stock cultures in log phase growth.<br>Mean test temperature: 24.2°C (sd = 0.5). Continuous light: intensity was 8431 to 8595 Lux. The pH ranged from 7.4 to 7.6 in the test solutions at test initiation and ranged from 7.0 to 8.7 at test termination.<br>Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. Test substance analysis was performed on samples of the WAFs at the start of the test (day 0) and at termination (day 4). The initial concentration of the test substance was not maintained at 80% in the three lower loading rates throughout the test (this may be due to biological activity or physical processes in the test chambers). It was appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing than to prepare dilutions of a stock solution. The test duration was 96 hours, instead of 72 hours. However, both 72 and 96-hour endpoints were determined.<br>None of the above exceptions are believed to have affected the outcome, integrity, or quality of the study. |
| **Results:**<br>**Units/Value:**<br>**Note: Analytical method, biological observations, control survival.** | Effects on growth rate (r) based upon actual loading rates:<br>72 hr ErL50 = 2.3 mg/L (CNC)<br>96 hr ErL50 = 2.1 mg/L (CNC)<br>72 and 96 hr NOELR = 0.39 mg/L<br>Effects on biomass (b) based upon actual loading rates:<br>72 hr EbL50 = 1.5 mg/L (1.3-1.6 mg/L)<br>96 hr EbL50 = 1.4 mg/L (1.3-1.6 mg/L)<br>72 hr NOELR = 0.20 mg/L<br>96 hr NOELR = 0.39 mg/L<br>Effects on growth rate (r) based upon measured concentrations:<br>72 hr ErC50 = 2.0 mg/L (CNC)<br>96 hr ErC50 = 1.8 mg/L (CNC)<br>72 and 96 hr NOEC = 0.42 mg/L<br>Effects on biomass (b) based upon measured concentrations:<br>72 and 96 hr EbC50 = 1.3 mg/L (1.2-1.4 mg/L)<br>72 hr NOEC = 0.07 mg/L<br>96 hr NOEC = 0.42 mg/L<br>Values in parentheses are 95% confidence intervals.<br>CNC = Could Not Calculate |

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| | The analytical method used was static headspace gas chromatography with flame ionization detection.<br>Summary of In-Life observations - % Inhibition<br>Loading Rate* (mg/L) Control 0.20 0.39 1.1 2.6 7.2<br>Meas. Conc.† (mg/L) 0 0.07‡ 0.42 1.1 2.1 6.4<br>Based on Growth Rate<br>72 hours n/a -2.0 0 11 83 97<br>96 hours n/a -1.7 -2.2 7.1 86 98<br>Based on Biomass<br>72 hours n/a -2.1 7.6 34 92 99<br>96 hours n/a -1.9 1.3 31 97 100<br>* Actual loading rate (weight) of test substance added to the vehicle/dilution water.<br>† Concentration based on mean (Day 0 and Day 4) measured concentrations.<br>‡ Based on Day 0 only, since the Day 4 sample was below detection limits.<br>Negative(-) value indicates a stimulatory effect. |
| **Conclusions:** | Effects on growth rate (r) based upon actual loading rates:<br>72 hr ErL50 = 2.3 mg/L<br>96 hr ErL50 = 2.1 mg/L<br>Effects on biomass (b) based upon actual loading rates:<br>72 hr EbL50 = 1.5 mg/L<br>96 hr EbL50 = 1.4 mg/L<br>Effects on growth rate (r) based upon measured concentrations:<br>72 hr ErC50 = 2.0 mg/L<br>96 hr ErC50 = 1.8 mg/L<br>Effects on biomass (b) based upon measured concentrations:<br>72 and 96 hr EbC50 = 1.3 mg/L |
| **Reliability:** | (1)-Reliable without restriction |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2004. ALGA, GROWTH INHIBITION TEST on HEAVY PYROLYSIS FUEL OIL. Study # 176867. |
| **Other (source):** | Olefins Panel, American Chemistry Council |

# Robust Summary
# Biodegradation

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| **Test Substance:** | Industry Stream Name : Heavy Pyrolysis Fuel Oil<br><br>CAS Number — CAS Inventory Name<br>68513-69-9 — Residue, petroleum, steam-cracked light<br>64741-62-4 — Clarified oils, petroleum, catalytic cracked<br>69013-21-4 — Fuel oil, pyrolysis<br>8002-05-9 — Petroleum<br><br>In ethylene plants cracking liquid feedstocks, the cracking furnace effluent (after heat recovery) is quenched by injection of recycled quench oil. This step results in the condensation of higher boiling hydrocarbon compounds that are typically separated from the rest of the furnace effluent as the bottoms of the oil quench tower. Lights are stripped from the excess oils generated from this quench system, resulting in the stream identified here as heavy pyrolysis fuel oil. |
| **Method/Guideline:** | OECD Guideline 301F |
| **Year (guideline):** | 1992 |
| **Type (test type):** | Ready Biodegradability: Manometric Respirometry Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Inoculum:** | Domestic activated sludge |
| **Exposure Period:** | 28 Days |
| **Test Conditions:**<br><br>• **Note: Concentration preparation, vessel type, replication, test conditions.** | Triplicate test systems were used to evaluate the biodegradability of the test and positive control substances at mean concentrations of 50 mg/L and 51 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in triplicate.<br><br>The total suspended solids (TSS) of the activated sludge was determined to be 3.32 g/L. The inoculum was added at a 1% loading volume of sludge supernatant to test medium. The microbial count of the inoculum was $10^5$ CFU/mL. One liter of test medium, which was aerated for 24 hours with carbon dioxide free air, was added to each one liter respirometer flask. The test substance was administered by direct addition on glass fiber filters into the test medium. The test system was sealed immediately after addition of the test substance. An aliquot of the positive control stock solution was added to the appropriate test flasks. |

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| **Test Conditions (cont'd):**<br><br>**Note: Concentration preparation, vessel type, replication, test conditions.** | An unacclimated activated sludge inoculum was used in this study. The inoculum was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, NJ, USA. The treatment plant receives domestic sewage.<br><br>All test systems were placed on a Coordinated Environmental Services (CES) automated respirometer which automatically recorded the oxygen uptake in general agreement with the OECD guideline. The 28-day study was conducted at a temperature range of 22 ± 1°C °C. |
| **Results:**<br><br>**Units/Value:**<br><br>**Note: Deviations from protocol or guideline analytical method.** | Biodegradation was based on oxygen consumption and the theoretical oxygen demand of the test substance as calculated using results of an elemental analysis of the test substance.<br><br>By day 14, >60% biodegradation of positive control was observed, which meets the guideline requirement. No deviations from the protocol occurred that affected the integrity of the study data.<br><br>The test substance biodegraded to 29% and cannot be considered readily biodegradable.<br><br>Sample — % Degradation* (day 28) — Mean % Degradation (day 28)<br>Test Substance — 33, 31, 22 — 29<br>Na Benzoate — 91, 87, 89 — 89<br><br>* replicate data |
| **Conclusion:** | Not readily biodegradable |
| **Reliability:** | (1)-Reliable without restriction. |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2003. Ready Biodegradability: Manometric Respirometry test. Study # 176894A |
| **Other (source): (FT - SO)** | Olefins Panel, American Chemistry Council |

**Robust Summary**
**Invertebrate Acute Toxicity**

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| **Test Substance:** | Industry Stream Name (acronym): Pyrolysis C10+ Fuel Oil (from Pyrolysis Gasoline Distillation)<br><br>CAS Number / CAS Inventory Name<br>68513-69-9 / Residues, petroleum, steam-cracked light<br>68921-67-5 / Hydrocarbons, ethylene-manuf.-by-product distn. residues<br><br>This stream is separated by distillation from pyrolysis gasoline, as a bottoms product. The composition indicates a carbon number distribution from C9 or C10 to hydrocarbons boiling at 650°F or higher. The reported typical composition includes 20% dicyclopentadiene, 30% codimers of C5 and C6 monomers, 20% naphthalene and substituted naphthalenes. |
| **Method/Guideline:** | OECD Guideline 202 |
| **Year (guideline):** | 1984 |
| **Type (test type):** | Daphnid Acute Toxicity Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Species:** | *Daphnia magna* Straus |
| **Analytical Monitoring:** | Yes |
| **Exposure Period:** | 48 hours |
| **Statistical Method:** | The 24 and 48-hour $EL_{50}$ and $EC_{50}$ values were determined using a Binomial Method (Stephan, 1977).<br>Stephan, C. E., Methods for Calculating an $LC_{50}$, *Aquatic Toxicology and Hazard Evaluation, ASTM STP 634*, F. L. Mayer and J. L. Hamelink, Eds., American Society for Testing and Materials, 1977, pp. 65-84. |
| **Test Conditions:**<br>• **Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.** | Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 12 L of reconstituted water in glass aspirator bottles (capacity 13.5 L). The solutions were mixed for 24 hours using a 3% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into four replicates of approximately 140 mL in 125 mL Erlenmeyer flasks (no headspace). Five daphnids were added to each replicate and the replicates were closed. The test was performed under static conditions with no aeration.<br>Mean test temperature: 20.1°C (S.D. = 0.1), diurnal light: approximately 16 hours light and 8 hours dark with 91 to 135 lux during full daylight periods. Dissolved oxygen ranged from 7.9 to 8.1 mg/L and pH ranged from 8.1 to 8.3 during the study. Water hardness was 144 mg/L as $CaCO_3$.<br>The daphnids were cultured in-house. Age was <24 hours old from 15-day old parents.<br>Due to the relatively complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing, rather than preparing dilutions of a stock solution as outlined in the guideline. |

<table>
<tr>
<td>Results:<br><br>Units/Value:<br><br>Note: Analytical method, biological observations, control survival.</td>
<td>Effect Loading ($EL_{50}$) / Effect Concentration ($EC_{50}$) Values (mg/L)<br>
<table>
<tr><td></td><td>$EL_{50}$</td><td>$EC_{50}$</td></tr>
<tr><td>24 hours</td><td>2.7 (1.8-4.1)</td><td>2.7 (1.7-4.2)</td></tr>
<tr><td>48 hours</td><td>1.2 (0.83-1.8)</td><td>1.2 (0.82-1.7)</td></tr>
</table>
Values in parentheses (  ) are 99% confidence intervals.<br><br>
The maximum actual loading rate causing no immobilization after 48 hours was 0.83 mg/L. The minimum actual loading rate causing 100% immobilization after 48 hours was 1.8 mg/L.<br><br>
The maximum measured concentration causing no immobilization after 48 hours was 0.82 mg/L. The minimum measured concentration causing 100% immobilization after 48 hours was 1.7 mg/L.<br><br>
The method of analysis was automated static headspace gas chromatography with flame ionization detection (HS GC-FID).<br>
<table>
<tr><td>Loading Rate (mg/L)</td><td>Measured Conc. (mg/L)</td><td colspan="2">% Immobilization</td></tr>
<tr><td></td><td></td><td>24-hour</td><td>48-hour</td></tr>
<tr><td>Control</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0.17</td><td>0.07</td><td>0</td><td>0</td></tr>
<tr><td>0.33</td><td>0.14</td><td>0</td><td>0</td></tr>
<tr><td>0.83</td><td>0.82</td><td>0</td><td>0</td></tr>
<tr><td>1.8</td><td>1.7</td><td>0</td><td>100</td></tr>
<tr><td>4.1</td><td>4.2</td><td>100</td><td>100</td></tr>
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<tr><td>Conclusion:</td><td>After Daphnia magna were exposed to WAFs prepared from Pyrolysis C10+ Fuel Oil (from Pyrolysis Gasoline Distillation) for 48 hours, the $EL_{50}$ and $EC_{50}$was 1.2 mg/L.</td></tr>
<tr><td>Reliability:</td><td>1-Reliable without restrictions.</td></tr>
<tr><td>Reference:</td><td>ExxonMobil Biomedical Sciences, Inc. 2004. Daphnia sp., ACUTE IMMOBILIZATION TEST on PYROLYSIS C10+ FUEL OIL (FROM PYROLYSIS GASOLINE DISTILLATION). Study # 176942</td></tr>
<tr><td>Other (source):</td><td>Olefins Panel, American Chemistry Council</td></tr>
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**Robust Summary**
**Fish Acute Toxicity**

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| **Test Substance:** | Industry Stream Name (acronym): Pyrolysis C10+ Fuel Oil (from Pyrolysis Gasoline Distillation)<br><br>CAS Number / CAS Inventory Name<br>68513-69-9 / Residues, petroleum, steam-cracked light<br>68921-67-5 / Hydrocarbons, ethylene-manuf.-by-product distn. residues<br><br>This stream is separated by distillation from pyrolysis gasoline, as a bottoms product. The composition indicates a carbon number distribution from C9 or C10 to hydrocarbons boiling at 650°F or higher. The reported typical composition includes 20% dicyclopentadiene, 30% codimers of C5 and C6 monomers, 20% naphthalene and substituted naphthalenes. |
| **Method/Guideline:** | OECD Guideline 203 |
| **Year (guideline):** | 1992 |
| **Type (test type):** | Fish Acute Toxicity Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Species:** | *Oncorhynchus mykiss* |
| **Analytical Monitoring:** | Yes |
| **Exposure Period:** | 96 hours |
| **Statistical Method:** | The 6-hour and 24-hour $LL_{50}$ and $LC_{50}$ values were determined using a maximum likelihood analysis based on D. J. Finney, 1971. A Trimmed Spearman-Karber Method (Hamilton et al.,1977) was used to determine the 48-hour, 72-hour and 96-hour $LL_{50}$ and $LC_{50}$ values.<br><br>Finney, D.J., 1971. Probit Analysis, 3rd Edition, London: Cambridge University Press.<br><br>Hamilton, M., R. Russo, R. Thurston, 1977. Trimmed Spearman-Karber Method for Estimating Median Lethal Concentrations in Toxicity Bioassays. *Environmental Science and Technology*, Vol. 11, No. 7, p.714-719. |
| **Test Conditions:**<br>• **Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.** | Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 18 L of reconstituted water in glass aspirator bottles (capacity 22 L). The solutions were mixed for 24 hours using a 3% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into three replicates of 4.5 L in 4 L size aspirator bottles (no headspace). Four fish were added to each replicate and the replicates were closed with foil covered neoprene stoppers. Daily renewals were performed by removing ~90% of the test solution through the outlet at the bottom of the aspirator bottle and refilling with fresh solution. The fish were received from Thomas Fish Company, Anderson, CA. The fish were not fed during the study. They were held for 13 days in study dilution water prior to use and were 29 days old at the start of the study. Fish mean weight = 0.206 g, mean total length = 3.1 cm, test loading = 0.183 g of fish/L.<br><br>Mean test temperature: 13.6°C (S.D. = 0.1), diurnal light: approximately 16 hours light and 8 hours dark with 607 to 614 Lux during full daylight periods. Dissolved oxygen ranged from 6.8 to 8.6 mg/L and pH ranged from 7.3 to 8.1 during the study. Water hardness was 104 mg/L as $CaCO_3$. |

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| | Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. The initial concentration of the test substance was not maintained at 80% in the highest loading rate throughout the test, 77% of the initial concentration was maintained. It was deemed more appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing, rather than preparing dilutions of a stock solution as outlined in the guideline. |
| **Results:**<br><br>**Units/Value:**<br><br>**Note: Analytical method, biological observations, control survival.** | The maximum actual loading rate causing no mortality after 96 hours was 0.47 mg/L. The minimum actual loading rate causing 100% mortality after 96 hours was 1.8 mg/L. The maximum measured concentration causing no mortality after 96 hours was 0.40 mg/L. The minimum measured concentration causing 100% mortality after 96 hours was 1.7 mg/L.<br><br>Lethal Loading ($LL_{50}$) / Lethal Concentration ($LC_{50}$) Values (mg/L)<br>$LL_{50}$ $LC_{50}$<br>3 hours >7.0* >6.3*<br>6 hours 6.8 (CNC) 6.2 (CNC)<br>24 hours 2.7 (2.2-3.2) 2.7 (2.2-3.3)<br>48 hours 1.8 (1.5-2.2) 1.7 (1.4-2.1)<br>72 hours 1.2 (1.1-1.3) 1.1 (1.0-1.2)<br>96 hours 1.1 (1.0-1.3) 1.0 (0.9-1.2)<br>* Not a calculated value, 8% mortality was observed in the highest loading rate/concentration tested.<br>Values in parentheses are 95% confidence intervals.<br>CNC = Could Not Calculate<br><br>The method of analysis was automated static headspace gas chromatography with flame ionization detection (HS GC-FID).<br><br>Summary of In-Life observations - % Mortality<br>Loading Rate (mg/L) Control 0.47 0.90 1.8 3.5 7.0<br>Meas. Conc. (mg/L) 0 0.40 0.79 1.7 3.7 6.3<br>3 hours 0 0 0 0 0 8<br>6 hours 0 0 0 0 0 67<br>24 hours 0 0 0 8 92 100<br>48 hours 0 0 0 50 100 100<br>72 hours 0 0 8 100 100 100<br>96 hours 0 0 17 100 100 100 |
| **Conclusion:** | After *Oncorhynchus mykiss* were exposed to WAFs prepared from Pyrolysis C10+ Fuel Oil (from Pyrolysis Gasoline Distillation) for 96 hours, the $LL_{50}$ was 1.1 mg/L and the $LC_{50}$ was 1.0 mg/L. |
| **Reliability:** | 1-Reliable without restrictions. |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2004. FISH, ACUTE TOXICITY TEST on PYROLYSIS C10+ FUEL OIL (FROM PYROLYSIS GASOLINE DISTILLATION). Study # 176958 |
| **Other (source):** | Olefins Panel, American Chemistry Council |

**Robust Summary**
**Alga Toxicity**

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| **Test Substance:** | Industry Stream Name (acronym): Pyrolysis C10+ Fuel Oil (from Pyrolysis Gasoline Distillation)<br><br>CAS Number / CAS Inventory Name<br>68513-69-9 / Residue, petroleum, steam-cracked light<br>68921-67-5 / Hydrocarbons, ethylene-manuf.-by-product distn. residues<br><br>This stream is separated by distillation from pyrolysis gasoline, as a bottoms product. The composition indicates a carbon number distribution from C9 or C10 to hydrocarbons boiling at 650°F or higher. The reported typical composition includes 20% dicyclopentadiene, 30% codimers of C5 and C6 monomers, 20% naphthalene and substituted naphthalenes. |
| **Method/Guideline:** | OECD Guideline 201 |
| **Year (guideline):** | 1984 |
| **Type (test type):** | Alga Toxicity Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Species:** | *Pseudokirchneriella subcapitata* |
| **Analytical Monitoring:** | Yes |
| **Exposure Period:** | 96 hours |
| **Statistical Method:** | The $E_bC_{50}$, $E_rC_{50}$ and confidence intervals for inhibition of growth/growth rate slope were determined by a probit regression calculation of the probit of the growth inhibition/growth rate slope vs the log of the concentration and associated confidence intervals based on the methods of D. J. Finney (Finney, 1971). Calculations were based on the PROC PROBIT procedure of SAS (SAS, 2002). The NOEC for the $E_bC_{50}$ and $E_rC_{50}$ was based on Multiple Range tests (Duncan's, 1975) and (Dunnett's, 1964), determined from the GLM procedure of SAS (SAS, 2002). The Shapiro-Wilk (Shapiro-Wilk, 1965) test for normality was used to test if the assumption of normality of the residuals was met; since the residuals were normally distributed the NOEC was based on the estimated values.<br><br>Finney, D.J. 1971. *Probit Analysis*, 3rd Edition, London: Cambridge University Press.<br>SAS Version 8, SAS Institute, Inc., Cary, NC. 2002.<br>Duncan, D.B. 1975, "t-Tests and Intervals for Comparisons Suggested by the Data", Biometrics, 31, 339-359.<br>Dunnett, C. 1964, "New Tables for Multiple Comparisons With A Control", Biometrics, Vol 20, No. 3, pg 482-491.<br><br>Shapiro, S.S. and Wilk, M.B. 1965,"n analysis of variance test for normality (complete samples)" Biometrika, 52, pg 591-611. |

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| **Test Conditions:**<br>• **Note: Concentration preparation, vessel type, volume, replication, environmental conditions, organisms supplier, loading, deviations from guideline or protocol.** | Individual Water Accommodated Fractions (WAF's) were prepared for each treatment. The test substance was added to 4.0 L of algal nutrient medium augmented with sodium bicarbonate in glass aspirator bottles (capacity 4.5 L). The solutions were mixed for 24 hours using a 7% vortex (of the static liquid depth). The test solutions were removed through the outlet at the bottom of each mixing vessel into 12 replicates of approximately 140 mL in 125 mL Erlenmeyer flasks (no headspace) containing two 14 mm glass spheres to facilitate mixing. The test chambers were inoculated with algae (1.0 x $10^4$ cells/mL) and were sealed with ground glass stoppers. Three replicates were sacrificed daily for cell density determination. The test chambers were placed on a shaker table (100 rpm) to keep the algae in suspension. The test was performed under static conditions with no aeration. The algae was cultured in-house from 5 day old stock cultures in log phase growth.<br>Mean test temperature: 24.5°C (sd = 0.3). Continuous light: intensity was 8288 to 8589 Lux. The pH ranged from 7.5 to 7.6 in the test solutions at test initiation and ranged from 7.8 to 9.5 at test termination.<br>Due to the complex nature and limited water solubility of the test substance, the following exceptions to the guideline apply for this study: The concentration of the test substance in solution was not determined prior to use. Test substance analysis was performed on samples of the WAFs at the start of the test (day 0) and at termination (day 4). The initial concentration of the test substance was not maintained at 80% in the three lower loading rates throughout the test (this may be due to biological activity or physical processes in the test chambers). It was appropriate to prepare individual treatment solutions by adding the test substance to dilution water and removing the WAF of each mixture for testing, rather than preparing dilutions of a stock solution as outlined in the guideline. The test duration was 96 hours, instead of 72 hours. However, both 72 and 96-hour endpoints were determined.<br>None of the above exceptions are believed to have affected the outcome, integrity, or quality of the study. |
| **Results:**<br>**Units/Value:**<br>**Note: Analytical method, biological observations, control survival.** | Effects on growth rate (r) based upon actual loading rates:<br>72 hr ErL50 = 2.3 mg/L (2.2 - 2.4 mg/L)<br>96 hr ErL50 = 2.2 mg/L (2.1 - 2.3 mg/L)<br>72 hr and 96 hour NOELR = 0.18 mg/L<br>Effects on biomass (b) based upon actual loading rates:<br>72 hr EbL50 = 1.3 mg/L (1.1 - 1.5 mg/L)<br>96 hr EbL50 = 1.2 mg/L (CNC)<br>72 hr and 96 hour NOELR = 0.18 mg/L<br>Effects on growth rate (r) based upon measured concentrations:<br>72 hr ErC50 = 1.7 mg/L (1.6 - 1.8 mg/L)<br>96 hr ErC50 = 1.6 mg/L (1.5 - 1.7 mg/L)<br>72 hr and 96 hour NOEC = 0.12 mg/L<br>Effects on biomass (b) based upon measured concentrations:<br>72 hr EbC50 = 0.95 mg/L (0.80 - 1.1 mg/L)<br>96 hr EbC50 = 0.91 mg/L (CNC)<br>72 hr and 96 hour NOEC = 0.12 mg/L<br>Values in parentheses are 95% confidence intervals.<br>CNC = Could Not Calculate |

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| | The analytical method used was static headspace gas chromatography with flame ionization detection.<br>Summary of In-Life observations - % Inhibition<br>Loading Rate (mg/L) Control 0.10 0.18 0.46 1.3 3.3<br>Meas. Conc. (mg/L) 0 0.04 0.12 0.36 0.99 2.4<br>Based on Growth Rate<br>72 hours n/a 0 -1.9 6.1 17 84<br>96 hours n/a 0 -2.9 1.1 18 88<br>Based on Biomass<br>72 hours n/a -1.0 -1.6 26 51 95<br>96 hours n/a -0.3 -7.1 16 60 98<br>Negative (-) value indicates a stimulatory effect. |
| **Conclusions:** | Effects on growth rate (r) based upon actual loading rates:<br>72 hr ErL50 = 2.3 mg/L<br>96 hr ErL50 = 2.2 mg/L<br>Effects on biomass (b) based upon actual loading rates:<br>72 hr EbL50 = 1.3 mg/L<br>96 hr EbL50 = 1.2 mg/L<br>Effects on growth rate (r) based upon measured concentrations:<br>72 hr ErC50 = 1.7 mg/L<br>96 hr ErC50 = 1.6 mg/L<br>Effects on biomass (b) based upon measured concentrations:<br>72 hr EbC50 = 0.95 mg/L<br>96 hr EbC50 = 0.91 mg/L |
| **Reliability:** | (1)-Reliable without restriction |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2004. ALGA, GROWTH INHIBITION TEST on PYROLYSIS C10+ FUEL OIL (FROM PYROLYSIS GASOLINE DISTILLATION). Study # 176967. |
| **Other (source):** | Olefins Panel, American Chemistry Council |

# Robust Summary
# Biodegradation

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| **Substance:** | Industry Stream Name (acronym): Pyrolysis C10+ Fuel Oil (from Pyrolysis Gasoline Distillation)<br><br>CAS Number — CAS Inventory Name<br>68513-69-9 — Residues, petroleum, steam-cracked light<br>68921-67-5 — Hydrocarbon, ethylene-manuf.-by-product distn. residues<br><br>This stream is separated by distillation from pyrolysis gasoline, as a bottoms product. The composition indicates a carbon number distribution of from C9 or C10 to hydrocarbons boiling at 650°F or higher. The reported typical composition includes 20% dicyclopentadiene, 30% codimers of C5 and C6 monomers, 20% naphthalenes and substituted naphthalenes. |
| **Method/Guideline:** | OECD Guideline 301F |
| **Year (guideline):** | 1992 |
| **Type (test type):** | Ready Biodegradability: Manometric Respirometry Test |
| **GLP (Y/N):** | Yes |
| **Year (study performed):** | 2003 |
| **Inoculum:** | Domestic activated sludge |
| **Exposure Period:** | 28 Days |
| **Test Conditions:**<br><br>• **Note: Concentration preparation, vessel type, replication, test conditions.** | Triplicate test systems were used to evaluate the biodegradability of the test and positive control substances at mean concentrations of 52.67 mg/L and 51.19 mg/L, respectively. Blank test systems, which did not contain the test or positive control substance, were run concurrently in triplicate.<br><br>The total suspended solids (TSS) of the activated sludge was determined to be 3.32 g/L. The inoculum was added at a 1% loading volume of sludge supernatant to test medium. The microbial count of the inoculum was $10^5$ CFU/mL. One liter of test medium, which was aerated for 24 hours with carbon dioxide free air, was added to each one liter respirometer flask. The test substance was weighed in an air tight syringe and injected into the test medium. The test system was sealed immediately after addition of the test substance. An aliquot of the positive control stock solution was added to the appropriate test flasks. |

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| **Test Conditions (cont'd):**<br><br>• **Note: Concentration preparation, vessel type, replication, test conditions.** | An unacclimated activated sludge inoculum was used in this study. The inoculum was obtained from the Clinton Sanitary Wastewater Treatment Plant, Annandale, NJ, USA. The treatment plant receives domestic sewage.<br><br>All test systems were placed on a Coordinated Environmental Services (CES) automated respirometer which automatically recorded the oxygen uptake in general agreement with the OECD guideline. The 28-day study was conducted at a temperature range of 22 ± 1°C. |
| **Results:**<br><br>**Units/Value:**<br><br>**Note: Deviations from protocol or guideline analytical method.** | Biodegradation was based on oxygen consumption and the theoretical oxygen demand of the test substance as calculated using results of an elemental analysis of the test substance.<br><br>By day 14, >60% biodegradation of positive control was observed, which meets the guideline requirement. No deviations from the protocol occurred that affected the integrity of the study data.<br><br>No biodegradation was observed in each of the triplicate test substance systems, therefore the test substance cannot be considered readily biodegradable.<br><br>Sample — % Degradation* (day 28) — Mean % Degradation (day 28)<br>Test Substance — 7, 3, 12 — 7<br>Na Benzoate — 91, 87, 89 — 89<br><br>* replicate data |
| **Conclusion:** | Not readily biodegradable |
| **Reliability:** | (1)-Reliable without restriction. |
| **Reference:** | ExxonMobil Biomedical Sciences, Inc. 2002. Ready Biodegradability: Manometric Respirometry test. Study # 176994A |
| **Other (source): (FT - SO)** | Olefins Panel, American Chemistry Council |