

Characterization of Bryan Mound Crude Oil for the National Oil and Hazardous Substances Pollution Contingency Plan Product Schedule (NCPPS)

Data Report



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Table of Contents

Disclaimer	ii
List of Tables	iv
List of Figures	iv
1 Introduction	1
2 Relevance.....	2
3 Methodology	4
3.1 Quality Assurance Project Plans.....	4
3.2 Oil and Dispersants	4
3.3 Dispersant Effectiveness Baffle Flask Test.....	4
3.4 Physico-Chemical Characterization of Source Oil.....	4
3.5 Toxicity	5
4 Results.....	6
4.1 Physico-Chemical Characterization	6
4.2 Dispersant Effectiveness	6
4.3 Toxicity	7
5 Summary	10
6 References	11
Appendices	12

List of Tables

Table 1. Dispersant Effectiveness of BMC oil.....	6
Table 2. Percent mean survival for acute toxicity testing.....	7
Table 3. Total Petroleum Hydrocarbon concentration within fractional WAF treatments and the median and 20 th percentile lethal concentration for acute toxicity testing.....	8

List of Figures

Figure 1. Dispersant Effectiveness of BMC oil.....	7
Figure 2. Percent survival as a function of Total Petroleum Hydrocarbons.....	9

1 Introduction

This data report summarizes the physical-chemical properties, aquatic toxicity, and dispersant effectiveness of Bryan Mound Crude (BMC) oil. BMC has been selected as a new reference oil for the National Oil and Hazardous Substances Pollution Contingency Plan Product Schedule (NCPPS). Analyses were conducted at the US Environmental Protection Agency (US EPA) Office of Research and Development (ORD) AWBERC Facility in Cincinnati, OH, and two contracted labs, Core Laboratories Saybolt in Deer Park, TX and Hydrosphere Research in Alachua, FL. ORD coordinated with the Office of Land and Emergency Management (OLEM) Office of Emergency Management (OEM) throughout the duration of this effort.

2 Relevance

Under section 311 of the Clean Water Act (CWA), as amended by section 4201 of the Oil Pollution Act of 1990 (OPA), the President is directed to prepare and publish the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for removal of oil and hazardous substances. Section 311(d)(2)(G) requires the President to include a Schedule identifying dispersants, other chemicals, and other spill mitigating devices and substances, if any, that may be used in carrying out the NCP. The authority of the President to implement this portion of the CWA is currently delegated to the U.S. Environmental Protection Agency (EPA) (56 FR 54757, 1991). Subpart J of the NCP governs the use of chemical or biological agents to respond to oil discharges.

The predecessor of the NCP was first published in 1970 (35 FR 8508) and contained Annex X - Schedule of Dispersants and other Chemicals to Treat Oil Spills. EPA became responsible for Annex X in 1973 (38 FR 21243). In 1994, EPA revised the NCP in response to the passage of the OPA (59 FR 47384) to its current regulatory requirements with respect to the authorization of use, data requirements for listing, and effectiveness and toxicity testing protocols for products on the Schedule. The current NCPPS Technical Notebook is maintained by EPA and contains a compilation of manufacturer product bulletins provided on safety, storage, application methods, toxicity and effectiveness data, and physical properties.

Oil spill remediation countermeasure products must be evaluated and approved before they may be used to remove or control discharges. Products listed in the NCP Product Schedule can be found at <https://www.epa.gov/emergency-response/alphabetical-list-ncp-product-schedule-products-available-use-during-oil-spill>. EPA requires that product manufacturers submit toxicity data for all products listed on the NCPPS. Dispersants and bioremediation agents must also undergo effectiveness testing using reference oils in accordance with the published testing protocols developed by the EPA (Venosa, 2002; Haines et al., 2003; Sorial et al., 2004 a and b).

NCPPS reference oils are maintained by the EPA. Bryan Mound Crude (BMC) oil was selected as a new reference oil for dispersant effectiveness testing (88 FR 38333, effective December 11, 2023) to replace dwindling supplies of existing oil. To be listed on the NCPPS, the dispersant must demonstrate for each temperature a dispersant effectiveness at the 95% lower confidence level (LCL₉₅) greater than or equal to 75% at 25°C and 70% at 5°C. Reported here are the results of BMC testing for chemical and physical characterization, dispersant effectiveness using select NCPPS dispersant products, and acute toxicity of BMC to two standard test species: an estuarine crustacean (mysid; *Americamysis bahia*) and an estuarine fish (inland silverside; *Menidia beryllina*). Results will be submitted to OLEM in support of the NCPPS and decision-making by On-

Scene Coordinators (OSCs) regarding products for use during emergency response operations.

3 Methodology

3.1 Quality Assurance Project Plans

L14866-QP-1-7 Category A

G-LRPCD-0021545-QP-1-1 Category B

3.2 Oil and Dispersants

Bryan Mound Crude (BMC) is a light, sweet crude oil, obtained from the Department of Energy Strategic Petroleum Reserve in 2021. Eight chemical dispersant products currently listed on the NCPPS were used to treat the oil and evaluate the dispersant effectiveness. Chemical dispersant products used were (in alphabetical order) Accell® Clean DWD, Corexit® EC9500A, Dispersit SPC 1000TM, Finasol® OSR 52, JD-2000 TM, Nokomis 3-AA, Saf-Ron Gold, and ZI-400. Products were chosen based on availability at the time of testing. Results are reported 'masked' to avoid bias.

3.3 Dispersant Effectiveness Baffle Flask Test

The EPA Baffle Flask Test (BFT) procedure was used for determining Dispersant Effectiveness (DE) for a specific oil-dispersant-temperature combination in six 150 mL baffled trypsinizing flasks (Venosa et al., 2002). Tests were conducted in controlled temperature rooms at 5 and 25 °C. Artificial seawater (120-mL of 31‰ adapted from Spotte et al., 1984) and 100 µL crude oil were added to the flask followed by 4 µL of a dispersant pipetted directly onto the oil slick to yield a Dispersant to Oil Ratio (DOR) of 1:25. The flasks received turbulent mixing at 250 rpm on an orbital shaker table. Following the mixing, the contents were allowed to settle for 10 ± 0.25 minutes to allow undispersed oil to reform a slick on the seawater surface before draining 30-mL through a stopcock at the base of the flask. The dispersed oil sample underwent liquid-liquid extraction using dichloromethane and analyzed with a UV-vis spectrophotometer between wavelengths of 340 – 400nm. The DE value, which is the lower 95% confidence limit of the six independent replicates (DE LCL95) was reported for each treatment.

3.4 Physico-Chemical Characterization of Source Oil

BMC oil was shipped to Deer Park, TX for characterization by a certified laboratory. A chemical assay for the oil was generated using standard methods and provided to the EPA. Assay methods and results can be found in the attachment within the Appendix. BMC oil was analyzed for monoaromatic hydrocarbons (i.e., benzene, toluene, ethylbenzene and xylenes; BTEX), polycyclic aromatic hydrocarbons (PAHs), and alkanes in the EPA laboratory in Cincinnati, OH. Analysis for BTEX was performed by adding oil-soaked absorbent pads to a vial and spiking with a deuterated BTEX mix, surrogate mix and internal standards. The samples were then quantified using an Agilent 7890A Gas Chromatograph (GC) with a 5975C mass selective detector (MSD) with Triple Axis Detector and CombiPal autosampler (CTC Analytics) following EPA Method 524.3 modified to perform head space analysis instead of purge and trap (US EPA, 2009). The concentrations of the target compounds were corrected based on the recoveries of the deuterated compounds and reported in nanograms. The mass of oil (in mg) attached to the absorbent pads was evaluated by extracting with DCM and measuring on a Shimadzu UV 1800 spectrophotometer. Final results are reported as ng BTEX per mg crude oil.

For analysis of PAHs and alkanes, oil samples were diluted in DCM and quantified using an Agilent 7890A GC with an Agilent 7000 GC/MS (GC/Mass Spectrometry) Triple Quad and a

CombiPal autosampler (CTC Analytics), equipped with a DB-5 capillary column by J&W Scientific (30 m, 0.25 mm I.D., and 0.25 mm film thickness) and a pulsed splitless injection port (US EPA, 2018). Alkanes analyzed included C10-C35 normal aliphatics and branched alkanes (pristine and phytane). PAHs analyzed included 2-4 ring compounds and their alkylated homologs (i.e., C0-C4 naphthalenes, C0-C4 phenanthrenes, C0-C3 fluorenes, C0-C4 dibenzothiophenes, C0-C4 naphthobenzothiophenes, C0-C4 pyrenes and C0-C4 chrysenes). Concentrations of the detected alkanes and PAHs were summed to compute total alkane and PAH concentrations, respectively (μg analyte/mg crude oil).

3.5 Toxicity

Toxicity testing was conducted at Hydrosphere Research, Inc. in Alachua, FL. Water Accommodated Fractions (WAFs) were prepared with oil loadings of 25 g oil per liter of water, under slow-stir conditions maintaining a 20% vortex for 18 h and settling for 6 h before sampling the aqueous exposure test solutions via slow siphon. Stock solutions were then serially diluted and used in toxicity tests (Barron and Ka'aihue, 2003). Fresh source oils, stock solutions and exposure media were extracted and analyzed for alkanes, BTEX, aromatics and Total Petroleum Hydrocarbons (TPH) at the EPA laboratory in Cincinnati, OH. Samples were analyzed for C9-C32 TPH by gas chromatography-flame ionization detection (GC-FID) following EPA SW-846, Method 8015B-DRO. Reported concentration of stock solutions in milligrams TPH/L was used to calculate exposure concentrations for all toxicity tests.

Acute toxicity experiments were conducted using two standard test species, estuarine crustacean (mysid; *Americamysis bahia*) and an estuarine fish (inland silverside; *Menidia beryllina*) at Hydrosphere Research, Inc. in Alachua, FL. Toxicity data were generated from tests with five concentrations and one control for each oil and test species. Standard toxicity test protocols and exposure conditions followed those summarized in Barron et al. (2018). The acute toxicity of oil was estimated using test-specific dose response data. These were generated from the average response across replicates as percent WAF and hydrocarbon metric (BTEX, TPH, alkanes, PAH) measured in each WAF. Effect concentrations for each metric of hydrocarbon exposure were based on concentrations in the stock WAF solution (initial measured), or on the geometric mean of the concentration in the stock WAF solution and exposure media at the end of the test period (day 2 or 4 of test). All statistical analyses were performed using the R statistical platform (v. 3.3.3) and associated packages (R Development Core Team, 2018; Ritz et al., 2015). Acute endpoints included the 20th centile and median lethal concentrations (LC20 and LC50, respectively).

4 Results

4.1 Physico-Chemical Characterization

A chemical assay for the oil was generated using standard methods and provided to the EPA. Assay data results can be found in the attachment within the Appendix. For additional chemical information, Department of Energy also maintains assay lists for all Strategic Petroleum Reserve oils (https://www.spr.doe.gov/reports/Crude_Oil_Assays.html). BMC oil is considered a light crude oil based on the density (0.8320 mg/ml at 15oC), API gravity (38.6 at 15oC) and viscosity (4.721 cSt at 25oC) values. BMC is considered a sweet crude due to low sulfur content of 0.377 % by mass. Hydrocarbon analyses showed total alkane concentration of 90.4 µg/mg and total PAH concentration of 15.70 µg/mg, on par with other light sweet crude oils.

4.2 Dispersant Effectiveness

BFT average effectiveness and DELCL95 values for BMC oil tested with masked chemical dispersants (DOR 1:25) are presented in Table 1. Histograms of these data are presented in Figure 1. Oil without dispersant (control) exhibited the lowest BFT DE LCL95 with values of 11.47% and 6.78 % at 25 and 5oC, respectively. Treatments with chemical dispersant exhibited higher DE values compared to the control. DE LCL95 values for oil treated with dispersants ranged between 51.46 - 96.10 % at 25oC and 50.52 - 91.80 % at 5oC. At 25 oC, Products B and C exhibited higher DE compared to products D, E, and G. Temperature did not appear to substantially impact DE in Products A, F and H.

Table 1. Dispersant Effectiveness of BMC oil treated with chemical dispersants (masked letters A-H) and untreated control at DOR 1:25. DE average and LCL95 % values are provided. Treatments were conducted at 25 and 5°C.

Dispersant Masked ID	25°C					5°C				
	Average (%)	Stdev (σ)	Variance (σ ²)	Coef. of Variation (RSD)	LCL ₉₅ (%)	Average (%)	Stdev (σ)	Variance (σ ²)	Coef. of Variation (RSD)	LCL ₉₅ (%)
A	98.44	5.92	35.10	6.02	93.57	95.13	3.49	12.18	3.67	91.80
B	98.46	2.87	8.21	2.91	96.10	93.01	6.14	37.74	6.61	87.96
C	96.98	1.51	2.27	1.55	95.54	89.16	6.28	39.49	7.05	83.99
D	89.48	5.13	26.32	5.73	85.26	90.59	1.67	2.79	1.84	89.00
E	87.74	2.68	7.20	3.06	85.18	91.56	2.52	6.34	2.75	89.16
F	58.78	8.89	79.02	15.12	51.46	55.93	6.57	43.14	11.74	50.52
G	64.03	10.22	104.49	15.96	55.62	74.86	9.10	82.88	12.16	67.37
H	76.03	6.34	40.22	8.34	70.82	78.46	11.07	122.55	14.11	69.36
Control	15.88	5.36	28.76	33.77	11.47	7.89	1.34	1.80	17.02	6.78

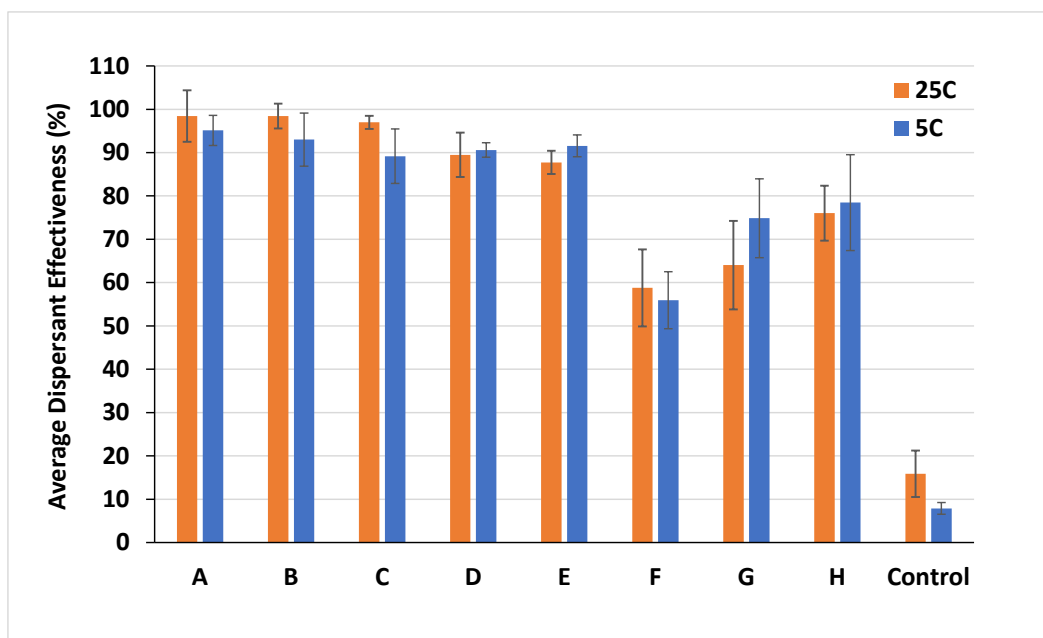


Figure 1. Dispersant Effectiveness of BMC oil treated with chemical dispersants (masked letters A-H) and untreated control at DOR 1:25. DE average and LCL₉₅ % values are provided. Treatments were conducted at 25 and 5°C. The error bars represent one standard deviation from the mean.

4.3 Toxicity

Toxicity results and monitoring of test conditions at Hydrosphere Research, Inc. laboratories can be found in the attachment within the Appendix. Acute toxicity for BMC oil without dispersant (oil-only) was compared using standard WAF mixing procedures. Acute definitive bioassay tests were conducted using two standard test species: mysid shrimp (*Americamysis bahia*; 48-hour) and inland silverside minnow (*Menidia beryllina*; 96-hour). Percent mean survival is provided in Table 2 where the 100 % WAF resulted in a mean survival of 60 % for (*A. bahia*) and 67% for (*M. beryllina*).

Table 2. Percent mean survival for acute toxicity testing of Bryan Mound Crude oil using standard species *Americamysis bahia* (48-hour) and *Menidia beryllina* (96-hour).

BMC %WAF	48-hour <i>A. bahia</i> Survival			96-hour <i>M. beryllina</i> Survival				
	0 hr	24 hr	48 hr	0 hr	24 hr	48 hr	72 hr	96 hr
Control	100	100	100	100	100	100	100	100
6.25	100	100	100	100	100	100	100	100
12.5	100	100	100	100	100	100	100	100
25	100	100	100	100	100	97	97	97
50	100	100	100	100	100	100	100	100
100	100	60	60	100	70	67	67	67
LC ₅₀ (%)	-	-	>100%	-	-	-	-	>100%

Total petroleum hydrocarbons (TPH) concentrations in the fractional and 100% WAFs ranged between 0.55 – 8.74 mg/L (Table 3). No reportable median lethal concentration (LC50) could be calculated based on survival and mean concentrations, however extrapolated values (LC50*) were calculated as 9.18 and 9.4 mg/L for *A. bahia* and *M. beryllina*, respectively. The 20th percentile lethal concentrations (LC20) were calculated as 7.1 mg/L for *A. bahia* and 8.1 mg/L

for *M. beryllina*. Figure 2 shows the percent survival as a function of TPH for both species. EPA's new decision-rule (88 FR 38333) does not require manufacturers to provide oil-only test results. Thus, median LC20 and LC50 values for the BMC oil without dispersant reported here will provide a comparative value for the EPA.

Table 3. Total Petroleum Hydrocarbon concentration within fractional WAF treatments and the median and 20th percentile lethal concentration for acute toxicity testing of Bryan Mound Crude oil using standard species *Americamysis bahia* (48-hour) and *Menidia beryllina* (96-hour).

Species	48-hour <i>A. bahia</i>	96-hour <i>M. beryllina</i>
Oil	BMC	BMC
Oil dosing	25g/L	25g/L
100% WAF conc at time 0hr (mg TPH/L)	8.74	8.74
<i>Control</i>	0.00	0.00
<i>Treatment 1 – 6.25 % WAF</i>	0.55	0.55
<i>Treatment 2 – 12.5 % WAF</i>	1.09	1.09
<i>Treatment 3 – 25 % WAF</i>	2.19	2.19
<i>Treatment 4 – 50 % WAF</i>	4.37	4.37
<i>Treatment 5 – 100 % WAF</i>	8.74	8.74
LC ₅₀ (%)	>100%	>100%
(CI _{95%})	--	--
LC ₅₀ (mg/L)	>8.74	>8.74
(CI _{95%})	--	--
LC ₅₀ (%) *	105	108
(CI _{95%})	83 - 127	73 - 143
LC ₅₀ (mg/L) *	9.18	9.4
(CI _{95%})	7.3 - 11.1	6.4 - 12.5
LC ₂₀ (%)	88.8	92.9
(CI _{95%})	43 - 133	64.6 - 121.3
LC ₂₀ (mg/L)	7.7	8.1
(CI _{95%})	3.8 - 11.7	5.6 - 10.6
Observed mortality at endpoint in 100% WAF	40% mortality	33.33% mortality
* extrapolated value		

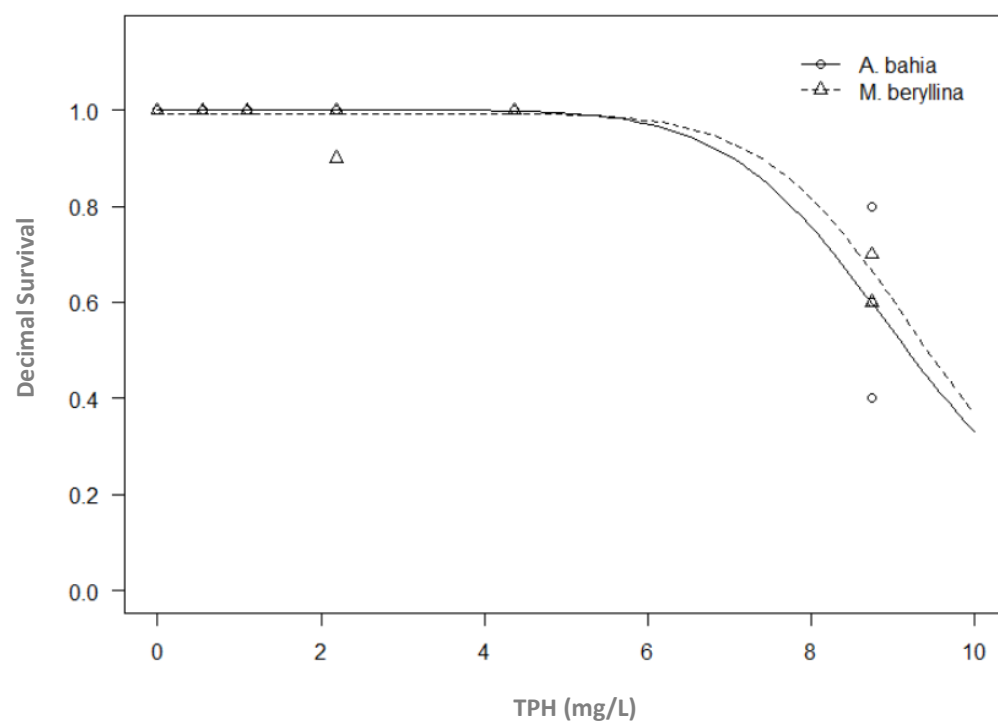


Figure 2. Percent survival as a function of Total Petroleum Hydrocarbons (TPH) for *A. bahia* and *M. beryllina* test species.

5 Summary

Reported here are the data results of the physical-chemical properties, aquatic toxicity, and dispersant effectiveness of Bryan Mound Crude (BMC) oil. BMC has been selected as a new reference oil for the National Oil and Hazardous Substances Pollution Contingency Plan Product Schedule (NCPSP; 88 FR 38333) for the EPA Office of Land and Emergency Management (OLEM) Office of Emergency Management (OEM).

6 References

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- 38 FR 21243 (1973) Assignment of functions under section 311 of the Federal Water Pollution Control Act, as Amended, Executive Order 11735, August 3, 1973.
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- US EPA (2018) Analysis of Semivolatile Organic Compounds by GC/MS, G-LMMD-SOP-1209-0.
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Appendices

APPENDIX 1



Providing Environmental and Product Toxicity Testing Since 1986

Prepared for:

Pegasus Technical Services
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Cincinnati, OH 45268



PEGASUS TECHNICAL SERVICES, INC.
Combining Management and Technical Consulting Services



Prepared by:

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Contact Information:

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Test Number:

PEG-01 22218

Tests Conducted:

48-Hour Acute Definitive Bioassay Studies with the mysid shrimp (*Americamysis bahia*)

96-Hour Acute Definitive Bioassay Studies with the inland silverside minnow (*Menidia beryllina*)

Samples Tested:

Bryan Mound Oil WAF

Report of Toxicity Tests Performed for Pegasus Technical Services

Bryan Mound Oil WAF

Abstract

At the request of Pegasus Technical Services, Hydrosphere conducted a series of bioassay tests to determine the potential aquatic acute toxicity effects of the Bryan Mound Oil Water Accommodating Fraction. Acute studies were conducted using the mysid shrimp (*Americamysis bahia*) and the inland silverside minnow (*Menidia beryllina*).

These tests were conducted in a manner consistent with EPA methods. Hydrosphere Research believes the results are true and accurate.

Revision 1

A data entry error was discovered after the original report was issued. A note has been added to the data sheet in appendix C, titled "Acute Saltwater Method (EPA-821-R-02-012, Method 2007.0)". The note corrects the data entry for the 100%, C replicate at 24 hours. The original value was recorded as "64" and should have been 8. This changed the 24-hour percent survival from 53% to 60%. The error does not change the report 48-hour LC₅₀. By extension, Table 4 was also corrected in this revision.



Peter R. Meyer, Laboratory Director

11/02/2023

Date

Table of Contents

Abstract.....	2
Table of Contents.....	3
Table of Figures.....	3
Introduction	4
Materials and Methods.....	4
WAF Preparation Figure 1. Bryan Mound Oil.....	4
WAF Sampling	6
Test Organisms.....	6
Test Methods	7
Results	8
Bryan Mound Oil WAF Test Results	8
Quality Assurance	9
Standard Reference Toxicant Test Results	9
Summary and Conclusions.....	10
References	10

Appendix A. Sample Shipping Labels

Appendix B. 48 & 96-hour Acute Raw Data Sheets & Statistical Results for the Range Finder Studies

Appendix C. 48 & 96-hour Acute Raw Data Sheets & Statistical Results for the Definitive Studies

Appendix D. Reference Toxicant Data for All Test Species

Table of Figures

Table 1. WAF Stock Solutions and Test Solutions Sub-Sampling.....	6
Table 2. Test Organism Information	6
Table 3. Summary of Test Methods.....	7
Table 4. 48-hour Acute <i>A. bahia</i> Survival.....	8
Table 5. 96-hour Acute <i>M. beryllina</i> Survival.....	9
WAF Preparation Figure 1. Bryan Mound Oil.....	4
Figure 2. WAF systems prior to covering for light blockage.....	5
Figure 3. 48-hour Acute <i>A. bahia</i> Survival	8
Figure 4. 96-hour Acute <i>M. beryllina</i> Survival	9

Introduction

The Bryan Mound oil was shipped from Pegasus Technical Services to Hydrosphere Research. Hydrosphere Research received the sample in good condition.

Using the Bryan Mound oil, Hydrosphere Research prepared Water Accommodating Fractions (WAF) in synthetic seawater. The WAF solutions were used to conduct acute effect concentration studies using the mysid shrimp (*Americamysis bahia*) and the inland silverside minnow (*Menidia beryllina*).

The laboratory bench sheets for the WAF range finding studies are included in Appendix A. The laboratory bench sheets for the WAF solutions effect concentration determination studies are in Appendix B. The Standard Reference Toxicity Tests are in Appendix C.

Materials and Methods

WAF Preparation

The WAF materials were prepared from control water and the Bryan Mound oil. The control water was synthetic seawater (SSW). Control water and a magnetic PTFE stir bar were added to a glass cylinder and the cylinder was placed on a stir plate. The cylinder was covered with a glass plate with a silicone gasket to seal the contents of the cylinder. The cover had two access holes fitted with a glass tub in one and a silicone stopper in the other. The glass tube allowed access to the WAF sample below the oil line. Bryan Mound oil was slowly added to the cylinder at the designated concentration of 25 gm/L. Stirring was initiated to energize the system. The goal was to achieve a shallow vortex of oil into the aqueous layer without having the oil break apart into globules. The goal was to have a vortex that was 20% of the aqueous layer's height. The system was carefully watched to ensure that the vortex did not break apart. The vortex was reduced to approximately 15%. Figure 2 below illustrates the setup. The cylinder and cover were wrapped with aluminum foil to keep the system dark. One section was left loose to allow observations.

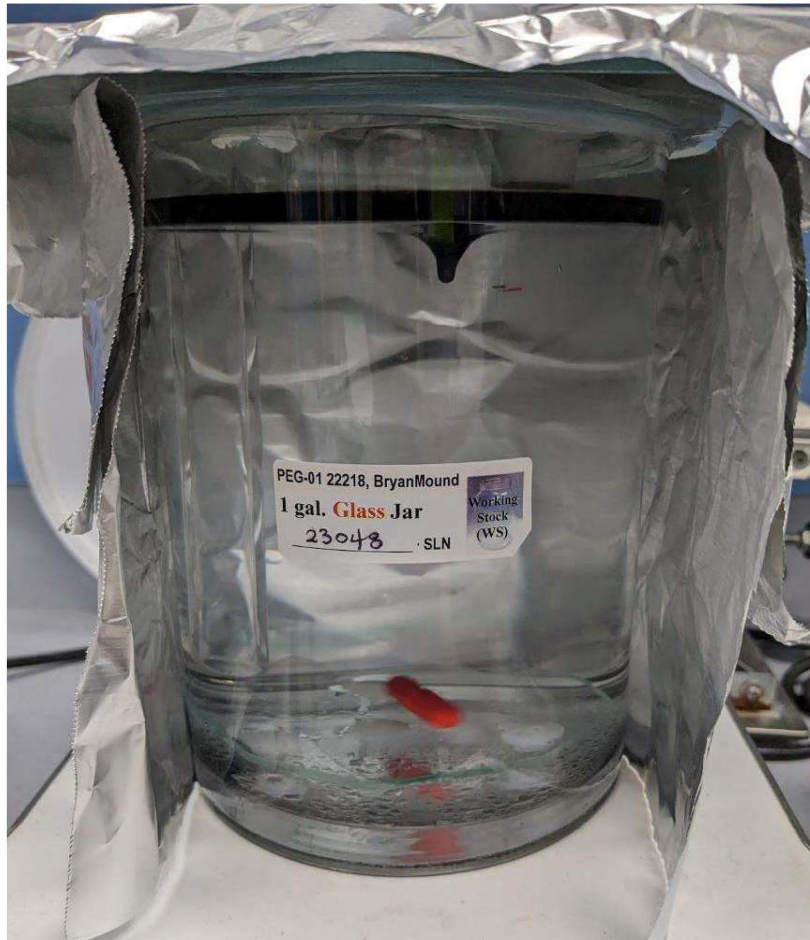
Stirring continued for 18 hours at room temperature. The system was checked periodically to ensure the vortex was stable. The stir plate was turned off after 18 hours and checked for any evidence that oil globules had broken off from the vortex during stirring. The system was then allowed to settle for 6 hours. At the end of the settling period, the WAF was collected by siphoning it with silicone tubing through the access tube in the glass plate cover into an aluminum foil wrapped glass jar. The jar was covered with a foil lined lid to prevent loss of volatile chemicals.

Figure 1. Bryan Mound Oil



The collected WAF sample preparation was recorded in the lab's "Chemical & Solutions Logbook" and assigned the number 23138-SLN. Other sample preparation notes were recorded on a "Laboratory Notes" bench sheet located in appendix B. These samples constitute the 100% WAF samples recorded on the test bench sheets. For the exposure test solutions, dilutions of the 100% WAF sample were prepared with the appropriate control waters.

Figure 2. WAF systems prior to covering for light blockage.



WAF Sampling

WAF stock solutions and test solutions were subsampled and shipped to Pegasus Technical Solutions, Inc. All samples were preserved with HCl. Below is a table which summarizes the WAF stock solutions and test solutions.

Table 1. WAF Stock Solutions and Test Solutions Sub-Sampling

Hydrosphere Solution ID	Hydrosphere Solution Description	Date Solution Prepared	Date Sampled	Date Shipped to Pegasus
SSW-5982	BryanMoundOil-WAF/230510/Salt/AcuteEC,Control,@0hr/SS&MS	5/10/23	5/10/23	5/15/23
23139-SLN	BryanMoundOil-WAF/230510/Salt/AcuteEC,6.25%,@0hr/SS&MS	5/10/23	5/10/23	5/15/23
23138-SLN	BryanMoundOil-WAF/230510/Salt/AcuteEC,100%,@0hr/SS&MS	5/10/23	5/10/23	5/15/23
23143-SLN	BryanMoundOil-WAF/230512/Salt/AcuteEC,Control,@48hr/MS	5/12/23	5/12/23	5/15/23
23144-SLN	BryanMoundOil-WAF/230512/Salt/AcuteEC,6.25%,@48hr/MS	5/12/23	5/12/23	5/15/23
23145-SLN	BryanMoundOil-WAF/230512/Salt/AcuteEC,100%,@48hr/MS	5/12/23	5/12/23	5/15/23
23146-SLN	BryanMoundOil-WAF/230514/Salt/AcuteEC,Control,@96hr/SS	5/14/23	5/14/23	5/15/23
23147-SLN	BryanMoundOil-WAF/230514/Salt/AcuteEC,6.25%,@96hr/SS	5/14/23	5/14/23	5/15/23
23148-SLN	BryanMoundOil-WAF/230514/Salt/AcuteEC,100%,@96hr/SS	5/14/23	5/14/23	5/15/23
UPW(0.055µS)	Field Reagent Blank (FRB)	5/10/23	5/10/23	5/15/23

Test Organisms

The test organisms used in this study were the mysid shrimp (*A. bahia*) and the inland silverside minnow (*M. beryllina*). The mysid shrimp (*A. bahia*) test organisms were cultured in-house. The inland silverside (*M. beryllina*) test organisms were commercially obtained (Aquatic Indicators, St. Augustine, FL).

The test organism information is described in Table 2. Test Organism Information.

Table 2. Test Organism Information

Test Organism	Source	Organism Age
<i>A. bahia</i>	In-house Cultures	3 days
<i>M. beryllina</i>	Commercially Obtained	12 days

Test Methods

The summary of the test methods used are described in the following table:

Table 3. Summary of Test Methods

	<i>Acute A. bahia</i>	<i>Acute M. beryllina</i>
Test method	EPA-821-R-02-012, Method 2007.0	EPA-821-R-02-012, Method 2006.0
Test type	Static non-renewal	Static non-renewal
Test duration	48 hours	96 hours
Salinity	20 ± 2‰	20 ± 2‰
Renewal	NA	NA
Temperature	25 ± 1 °C. Test temperatures must not deviate (maximum minus minimum temperature) by more than 3 °C during the test.	
Light quality	Ambient laboratory illumination	
Light intensity	10–20 (E/m ² /s)	
Photoperiod	16 h light, 8 h darkness, with phase in/out period recommended	
Test chamber size	500 mL	1 L
Test solution volume.	200 mL	200 mL
Age of test organism	1–5 days	9–14 days
No. organisms per test chamber	10	10
No. of replicate chambers per concentration	3	3
Feeding regime	Refer to specific feeding procedures provided in each test method	
Aeration	None, unless DO falls below 4.0 mg/L, then aerate all chambers. Rate: <100 bubbles/minute	
Physical / Chemical Measurements	Daily temperatures were measured in one replicate for each test concentration. Exposure test solutions were analyzed daily for pH, dissolved oxygen, and either conductivity or salinity.	
Test concentrations	5 exposure concentrations and a control	
Test acceptability chambers per concentration	≥90% survival in controls	

All statistical calculations were made using CETIS® (Tidepool Scientific Software, McKinleyville, CA). The sample statistical results are in Appendices A and B.

The bioassay tests were performed at Hydrosphere Research, 11842 Research Circle, Alachua, FL 32615; telephone number (386) 462-7889. The laboratory is NELAC/P certified by the State of Florida Department of Health and Rehabilitation Services (E82295).

Results

Bryan Mound Oil WAF Test Results

The results of the acute definitive tests are summarized in the tables and figures below. The raw data and bench sheets are included in Appendix B.

Table 4. 48-hour Acute *A. bahia* Survival

48-hour <i>M. bahia</i> % Mean Survival				
Bryan Mound Oil WAF	% WAF	0 Hours	24 Hours	48 Hours
	Control	100	100	100
	6.25	100	100	100
	12.5	100	100	100
	25	100	100	100
	50	100	100	100
	100	100	60	60
	LC50	-	-	>100%

Figure 3. 48-hour Acute *A. bahia* Survival

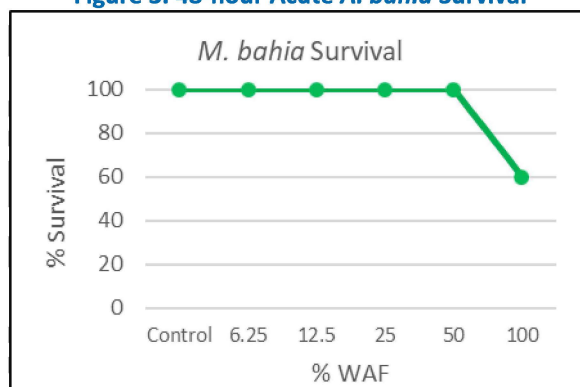
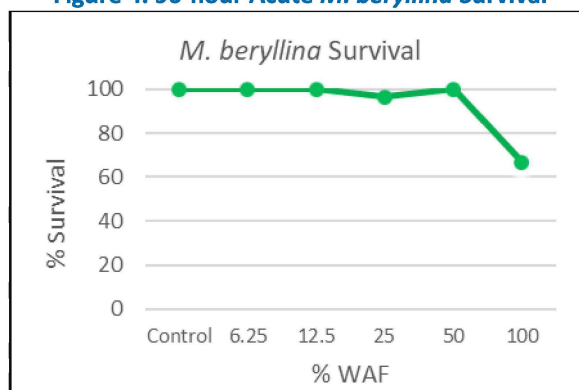


Table 5. 96-hour Acute *M. beryllina* Survival

96-hour <i>M. beryllina</i> % Mean Survival						
Bryan Mound Oil WAF	% WAF	0 Hours	24 Hours	48 Hours	72 Hours	96 Hours
	Control	100	100	100	100	100
	6.25	100	100	100	100	100
	12.5	100	100	100	100	100
	25	100	100	97	97	97
	50	100	100	100	100	100
	100	100	70	67	67	67
	LC50	-	-	-	-	>100%

Figure 4. 96-hour Acute *M. beryllina* Survival



Quality Assurance

All phases of the study including, but not limited to, sample handling and storage, glassware preparation, test organism culturing/acquisition and acclimation, test organism handling during test, and maintaining appropriate test conditions were conducted per the applicable method. No known deviations were noted during the study.

All chemicals were certified products used before expiration dates (where applicable). All identification, service, and calibration information pertaining to laboratory instruments is recorded in calibration and maintenance logbooks. The bioassay tests were acceptable tests based on control performance and test conditions.

Standard Reference Toxicant Test Results

The results for the standard reference toxicant tests are in Appendix C which includes the control charts, statistics, and raw data.

Summary and Conclusions

The Bryan Mound Oil Water Accommodating Fraction produced a 48-hour LC₅₀ of >100% for the mysid shrimp (*Americamysis bahia*) and a 96-hour LC₅₀ of >100% for the inland silverside minnow (*Menidia beryllina*).

Dissolved oxygen, temperature, and pH remained within the limits established in the test methods. The Acute and Chronic Standard Reference Toxicant tests demonstrated that the test organisms used in this study were of acceptable health and sensitivity.

No unusual observations or deviations from standard test protocol were noted. No unusual qualitative test organism behaviors were observed in the test exposures. These test results only relate to the samples described in this report and meet all requirements of NELAC.

References

U.S. Environmental Protection Agency. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. Fifth Edition. EPA-821-R-02-012. October 2002.

Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing (40 CFR Part 136). EPA 821-B-00-004. July 2000.

Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019. March 1979.

Chemical and physical parameters reported herein were determined by methods described in *Methods for Chemical Analysis of Water and Waste*. EPA 600/4-79-020. March 1983.

Comprehensive Environmental Toxicity Information System (CETIS®), Version 1.9.7.9, Tidepool Scientific Software, McKinleyville, CA.

Appendix A.

Sample Shipping Labels

RETURN USEPA - OARM

23/Aug/2022 22:00 4626

JENNIFER TANT
(513) 569-7185
US EPA
28 W. MARTIN LUTHER KING DRIVE
CINCINNATI OH 45268-0001

5 LBS

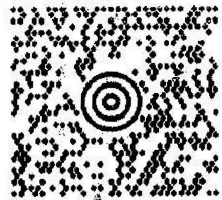
DWT: 8.8,10

1 OF 1

SHIP TO:

PETER MEYER
(386) 462-7889
HYDROSPHERE RESEARCH ENV SERVICES
11842 RESEARCH CIRCLE
ALACHUA FL 32615-6817

RECEIVED 8.26.22 @ ~10:00 PM
CHEM LOG 22071-CHM

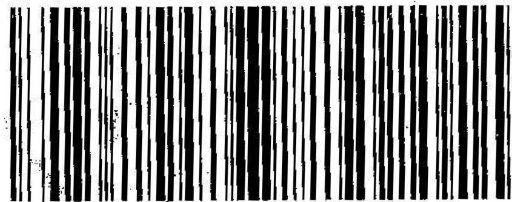


FL 326 0-02



UPS GROUND

TRACKING #: 1Z A43 F24 03 5056 0256



BILLING: 3RD PARTY
HAZARDOUS MATERIALS - GROUND ONLY
HAZ# UN1267

Reference Name: Robyn Conmy
Dept: CESER/HSMMD

See back of this label for terms, conditions, and notice of limitation of liability. Where allowed by law, shippers authorize UPS to act as forwarding agent for receipt, storage and return of hazardous materials. It is the shipper's responsibility to ensure that the commodity, technology or software were reported from the US in accordance with the Export Administration Regulations. Shipment contrary to law is prohibited.

For information about UPS's privacy practices or to opt out from the sale of your information, please see the UPS Privacy Notice at www.ups.com BFO 8 0921

Acceptance Number A43F24	Emergency Contact Number 7786833-8787	For Air Services Only The shipment is within the weight and dimensions limits (delete non-applicable boxes) P300X Aircraft X00X Aircraft Only
-----------------------------	--	--

Reference Number 1Z A43 F24 03 5056 0256	ER Registrant Jennifer Tant	Hazardous Materials Description and Quantity UN1267, Petroleum crude oil, 3, 1, 1 Fiberboard Box x 0.9 L
---	--------------------------------	---

Carrier Use Only Initials SIC Date Signature	
--	--

ALACHUA FL 32618
HYDROSPHERE RESEARCH ENV SERVIC
11842 RESEARCH CIR
P: BLUE
S: IN
HIPO - 1636
0256
1: 628

Appendix B.

48 & 96-hour Acute Raw Data Sheets & Statistical Results for the Range Finder Studies



Client:	Pegasus Technical Services, Inc.		
Code:	PEG-01	Job:	22218
Species:	<i>Mysidopsis bahia</i>	Code:	MS
ID #:	2072	Age:	5d <input checked="" type="checkbox"/> Lab, <input type="checkbox"/> Com

Control Water:	SSW
Diluent:	SSW
Test Vessel:	500-mL Glass Jar
Test Volume:	200-mLs per replicate

Initiation Date:	3/8/23	Termination Date:	3/10/23
Sample Description:			
Product: Fuel oil WRD WAF (25 gm/L)			
Test: Range-finder (RF)			

Sample Description	%	R E P	Live Counts		
	WAF		W	R	F
			0h	24h	48h
Control	0	A	10	10	10
		B	10	10	10
		C	10	10	10
WAF	0.01	A	10	10	10
		B	10	10	10
		C	10	10	10
	0.1	A	10	10	10
		B	10	10	10
		C	10	10	10
	1	A	10	10	10
		B	10	10	10
		C	10	10	10
	10	A	10	10	10
		B	10	10	10
		C	10	10	10
	100	A	10	10	10
		B	10	10	10
		C	10	10	10
Meter ID #:			420	421	428
Initials:			BB	DM	RG

pH			
(acceptable range for a valid test is 6 to 9)			
0h new	24h old solution	48h old solution	
7.9	7.7	8.0	
8.0	8.0	7.9	RG
		8.1	3110
8.1	8.0	8.0	
8.1	8.0	8.1	
8.1	8.0	8.1	
8.1	8.0	8.1	
428	421	428	
ML	DM	RG	

Dissolved Oxygen (mg/L)				
(acceptable minimum for a valid test is 4.0-mg/L)				
0h new	24h old solution	48h old	new	
7.3	7.5	7.4		
7.3	7.4	7.4		
7.4	7.4	7.4		
7.4	7.4	7.3		
7.4	7.4	7.3		
7.4	7.3	7.3		
428	421	428		
ML	DM	RG		

Salinity (‰)				
(20±2‰ FedReg / Vol80, No14 / Jan2015)				
0h new	24h old solution	48h old	new	
20.8	20.5	21.3		
20.8	20.6	21.6		
20.8	20.3	21.2		
20.8	20.6	21.8		
20.8	20.5	21.4		
20.8	20.4	21.4		
428	421	428		
ML	DM	RG		

Notes & Comments	
① BRYAN MOUND OIL - 2/23/23	

Photoperiod is 16L:8D, Illumination is ambient (50 to 100 fcd)

① Check Box: Lab = In-House Reared, Com = Commercially obtained

Control ID:	5917	Termine Test 4:50- min of initiation time
Diluent ID:	5917	
Working Stock ID:	23048 · SLN	
Oil ID ID:	22071 · CHM	
Randomization Template #	2	
Feeding Type:	Artemia (concentrated slurry)	
Amount:	2-drops (0.1-mL) 2-times, daily	
Time:	WA 930 930	
	1530 1600	

Sample Description	%	Temperature (°C)		
		(acceptable range for a valid test is 25±1°C)		
WAF	0	25.0	25.4	25.7
	0.01	25.0	25.2	25.7
	0.1	25.0	25.2	25.7
	1	25.0	25.1	25.7
	10	25.0	25.0	25.7
	100	25.0	24.7	25.6
		428	426	425
Meter ID #:				

CETIS Analytical Report

Report Date: 14 Mar-23 12:11 (p 1 of 2)

Test Code/ID: PEG-01 22218MSA / 16-4365-1580

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 11-3875-8435 Endpoint: 48h Survival Rate CETIS Version: CETISv1.9.7
Analyzed: 14 Mar-23 12:11 Analysis: Linear Interpolation (ICPIN) Status Level: 1
Edit Date: 14 Mar-23 12:10 MD5 Hash: 92B8802B84E90A6B6D096CCFF74D484 Editor ID: 003-737-857-6

Batch ID: 18-0705-0917 Test Type: Survival (48h) Analyst: Lab Tech
Start Date: 08 Mar-23 16:00 Protocol: EPA/821/R-02-012 (2002) Diluent: ~~Mod Hard Synthetic Water~~
Ending Date: 10 Mar-23 15:35 Species: Mysisidopsis bahia Brine: ~~SSW 5917~~
Test Length: 48h Taxon: Malacostraca Source: In-House Culture Age: 5d

Sample ID: 18-0787-2617 Code: 6BC1F269 Project: Product Toxicity Test
Sample Date: 08 Mar-23 Material: Product Source: Pegasus Technical Services
Receipt Date: 08 Mar-23 CAS (PC): Station: ~~Fuel Oil WRD WAF~~
Sample Age: 16h Client: Pegasus ~~Bryen Round oil~~
~~RA-331~~

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1528842	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC50	>100	---	---

48h Survival Rate Summary

Calculated Variate(A/B)

Isotonic Variate

Conc-mg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	D	3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
0.01		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
0.1		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
1		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
10		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
100		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%

48h Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	1.0000	1.0000	1.0000
0.01		1.0000	1.0000	1.0000
0.1		1.0000	1.0000	1.0000
1		1.0000	1.0000	1.0000
10		1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000

48h Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	✓ 10/10	✓ 10/10	✓ 10/10
0.01		✓ 10/10	✓ 10/10	✓ 10/10
0.1		✓ 10/10	✓ 10/10	✓ 10/10
1		✓ 10/10	✓ 10/10	✓ 10/10
10		✓ 10/10	✓ 10/10	✓ 10/10
100		✓ 10/10	✓ 10/10	✓ 10/10

CETIS Analytical Report

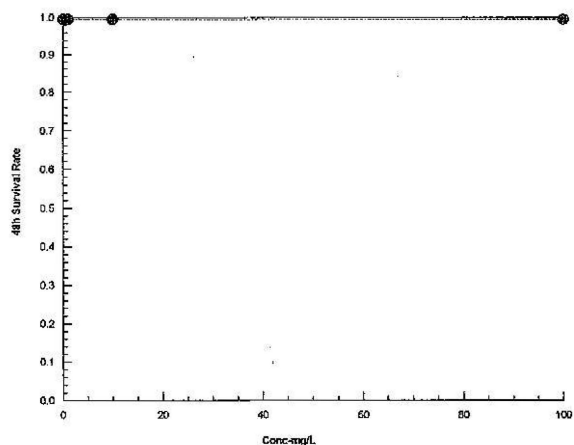
Report Date: 14 Mar-23 12:11 (p 2 of 2)
Test Code/ID: PEG-01 22218MSA / 16-4365-1580

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 11-3875-8435	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 14 Mar-23 12:11	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 14 Mar-23 12:10	MD5 Hash: 92B8802B84E90A6B6D096CCFF74D484	Editor ID: 003-737-857-6

Graphics





Client:	Pegasus Technical Services, Inc.		
Code:	PEG-01	Job:	22218
Species:	<i>Mentidia beryllina</i>	Code:	SS
ID #:	2065	Age:	12d <input type="checkbox"/> Lab, <input checked="" type="checkbox"/> Com

Control Water:	SSW
Diluent:	SSW
Test Vessel:	1-L Glass Jar
Test Volume:	200-mLs per replicate

Initiation Date:	3/8/23	Termination Date:	3/12/23
Sample Description:			
Product: Fuel oil WRD WAF (25 gm/L)			
Test: Range-finder (RF)			

Sample Description	%	REP	Live Counts				
			W	R	F	S _m	S _i
Control	0	A	10	10	10	10	10
		B	10	10	10	10	9
		C	10	10	9	9	9
WAF	0.01	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	9	9	9	8
	0.1	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	9	9
	1	A	10	10	9	9	9
		B	10	10	10	10	10
		C	10	10	10	10	10
	10	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	8	8
	100	A	10	9	9	9	9
		B	10	8	8	8	8
		C	10	10	9	9	9

pH				
(acceptable range for a valid test is 6 to 9)				
0 new	24 old solution	48 old solution	72 old solution	96 old
7.9	7.8	7.8	7.9	7.9
8.0	8.0	7.9	8.1	8.0
8.1	8.0	8.0	8.1	8.1
8.1	8.0	8.0	8.1	8.0
8.1	8.0	8.0	8.1	8.1
8.1	8.0	8.0	8.1	8.1
8.1	8.0	8.0	8.1	8.1
8.1	8.0	8.0	8.1	8.1

Dissolved Oxygen (mg/L)				
(acceptable minimum for a valid test is 4.0-mg/L)				
0 new	24 old solution	48 old solution	72 old solution	96 old
7.3	7.3	7.4	7.5	7.4
7.3	7.3	7.4	7.4	7.3
7.4	7.3	7.4	7.4	7.3
7.4	7.3	7.4	7.4	7.3
7.4	7.3	7.4	7.4	7.3
7.4	7.3	7.3	7.4	7.2
7.4	7.3	7.3	7.3	7.2
7.4	7.3	7.3	7.3	7.2

Salinity (‰)				
(20±2‰; FedReg / Vol80, No14 / Jan2015)				
0 new	24 old solution	48 old solution	72 old solution	96 old
20.8	20.5	20.4	20.7	20.6
20.8	20.5	20.8	21.0	21.1
20.8	20.5	20.9	21.4	21.5
20.8	20.3	20.5	20.8	20.8
20.8	20.4	20.6	20.9	20.9
20.8	20.4	20.6	20.8	20.8
20.8	20.4	20.6	20.8	20.8
20.8	20.4	20.6	20.8	20.8

Meter ID #:	421	421	411	421
Initials:	MC	DM	DM	RM
Time:	1545	1434	1449	1525
Control ID:	5917			
Diluent ID:	5917			
Working Stock ID:	23048 - SLN			
Oil ID ID:	22071 - CHM			
Randomization Template #	2			
Feeding Type:	Artemia (concentrated slurry)			
Amount:	none			
Time:				

Notes & Comments	
① 9 ⁰⁰ PM 3/9/23	
② BRYAN MOUND OIL, 3/12/23	

Photoperiod is 16L:8D, Illumination is ambient (50 to 100 ftd)
 ① Check Box: Lab = In-House Reared, Com = Commercially obtained

Temperature (°C)		(acceptable range for a valid test is 25±1°C)				
		0	24	48	72	96
Sample Description	Control	25.1	25.3	25.6	25.0	25.6
	0.01	25.1	25.4	25.5	25.1	25.5
	0.1	25.0	25.5	25.6	25.1	25.6
	1	25.0	25.4	25.5	25.2	25.5
	10	25.0	25.5	25.4	25.2	25.4
WAF	100	25.1	25.5	25.3	25.3	25.5
	Meter ID #:	421	426	426	425	426

CETIS Analytical Report

Report Date: 14 Mar-23 12:12 (p 1 of 2)

Test Code/ID: PEG-01 22218 10-1101-7421

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 15-2719-7493	Endpoint: 96h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 14 Mar-23 12:12	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 14 Mar-23 12:05	MD5 Hash: 6A22360F0EE35D2B537C2F23E926E9CB	Editor ID: 003-737-857-6
Batch ID: 12-1014-8483	Test Type: Survival (96h)	Analyst: Lab Tech
Start Date: 08 Mar-23 15:45	Protocol: EPA/821/R-02-012 (2002)	Diluent: Med-Hard Synthetic Water
Ending Date: 12 Mar-23 15:25	Species: <u>Menidia beryllina</u>	Brine: <u>SSW-5917</u>
Test Length: 96h	Taxon: Actinopterygii	Source: In-House Culture Age: J2 d
Sample ID: 05-9696-9274	Code: 2395073A	Project: Product Toxicity Test
Sample Date: 08 Mar-23	Material: Product	Source: Pegasus-Technical Services
Receipt Date: 08 Mar-23	CAS (PC):	Station: <u>Fuel Oil WRD WAF</u>
Sample Age: 16h	Client: Pegasus	<u>Dryer Mound 6/1</u>

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	434087	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	0.9333	0.9	>>	Yes	Passes Criteria

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC50	>100	---	---

96h Survival Rate Summary

Calculated Variate(A/B)

Isotonic Variate

Conc-mg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	D	3	0.9333	0.9000	0.9000	1.0000	6.19%	0.00%	28/30	0.9500	0.00%
0.01		3	0.9333	1.0000	0.8000	1.0000	12.37%	0.00%	28/30	0.9500	0.00%
0.1		3	0.9667	1.0000	0.9000	1.0000	5.97%	-3.57%	29/30	0.9500	0.00%
1		3	0.9667	1.0000	0.9000	1.0000	5.97%	-3.57%	29/30	0.9500	0.00%
10		3	0.9333	1.0000	0.8000	1.0000	12.37%	0.00%	28/30	0.9333	1.75%
100		3	0.8667	0.9000	0.8000	0.9000	6.66%	7.14%	26/30	0.8667	8.77%

96h Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	1.0000	0.9000	0.9000
0.01		1.0000	1.0000	0.8000
0.1		1.0000	1.0000	0.9000
1		0.9000	1.0000	1.0000
10		1.0000	1.0000	0.8000
100		0.9000	0.8000	0.9000

96h Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	✓ 10/10	✓ 9/10	✓ 9/10
0.01		✓ 10/10	✓ 10/10	✓ 8/10
0.1		✓ 10/10	✓ 10/10	✓ 9/10
1		✓ 9/10	✓ 10/10	✓ 10/10
10		✓ 10/10	✓ 10/10	✓ 8/10
100		✓ 9/10	✓ 8/10	✓ 9/10

CETIS Analytical Report

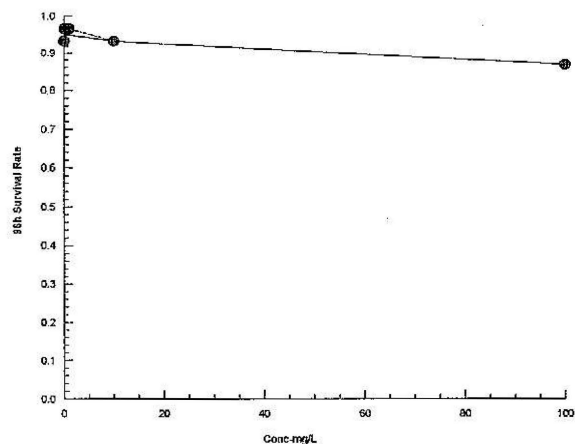
Report Date: 14 Mar-23 12:12 (p 2 of 2)
Test Code/ID: PEG-01 22218 / 10-1101-7421

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID:	15-2719-7493	Endpoint:	96h Survival Rate	CETIS Version:	CETISv1.9.7
Analyzed:	14 Mar-23 12:12	Analysis:	Linear Interpolation (ICPIN)	Status Level:	1
Edit Date:	14 Mar-23 12:05	MD5 Hash:	6A22360F0EE35D2B537C2F23E926E9CB	Editor ID:	003-737-857-6

Graphics

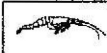


Client: **Pegasus Technical Services** Code: **PEG-01** Job: **22218**

Task Title: **25 gm/L WAF prep** Task Page 1 of 2

1) Product Name: **Bryan Mound Oil** Tech Initials: **PRM**

2) Lab ID: **22071** · CHM Date: **3/7/2023**

OIL ~ WAF Preparation (Range-finding Test)			
oil mass for WAF	25	g/L	
	Saltwater Tests		
%	SS	MS	Both
	600	600	1200
0.01	0.06	0.06	0.12
0.1	0.6	0.6	1.2
1	6	6	12
10	60	60	120
100	600	600	1200
Bioassay WAF (mLs)	666.66	666.66	1333.32
Number of renewals	1		
WAF for renewals (mL)	1333.32		
Oil chem for WAF	1000		
BTEX for WAF	80		
Total WAF (mL)	2413		
Rounded	2700		
Mass of Oil (gm)	67.5		

Glass Cylinder		Inside dimensions (measured, not calc!)	
6	diameter (in)	14.3	cm (width) Item 1
8	height (in)	18.7	cm (height) Item 2
20.32	height (cm)	3.0	L (volume) Item 3
OIL ~ WAF			
OIL ~ WAF Preparation (Range-finding Test)			
Saltwater SS & MS			
Item 4	WAF needed	2700	mLs
Item 5	Cylinder	3003.3	mLs
Item 6	WAF height	16.81	cm (from inside bottom, up)
Item 7	height+20%	20.17	cm (from inside bottom, up)
Item 8	cover ht of	18.7	cm (from inside bottom, up)
Item 9	is what %?	11.2	% (shoot for 20%)
Item 10	20% vortex	13.45	cm (from inside bottom, up)
OIL			
from "Mass of Oil (gms)"			
Item 11	Oil needed	67.5	~ mLs
Item 12	Diameter	14.30	cm
Item 13	Oil thickness	0.42	cm

Labor Hours to perform tasks on this page: **NA**

Client: **Pegasus Technical Services** Code: **PEG-01** Job: **22218**

Task Title: **25 gm/L WAF prep** Task Page 2 of 2

1) Product Name: **Bryan Mound Oil** Tech Initials: **PRM**

2) Lab ID: **22071** · CHM Date: **3/7/2023**
WAF Mixture

Oil Mass:	25	gms/L	1) Initiation 18-hours of Mixing on Stir Plate (Target is to achieve a 20% vortex)			
Oil ID:	22071	· CHM				
Water Volume:	2.70	L				
Water ID:	5917	SSW	Date :	3/7/2023		
Product (unit/L):	NA	units gm	Time:	14:10	Init	PRM
Product ID:	NA	· CHM	Product Target:	#VALUE!	units	gm
Event	Mass (gms)	Action	Product added :		units	gm
A	Oil Needed	67.5	Tare Cup	Time:	NA	Init NA
B	Add Oil to Cup ①	68.01	weigh	Vortex Height:	14	%
C	Left in Cup	2.09	weigh			
D	Total Oil in Jar	65.92	B-C	2) Terminate Mixing (at 18-hours)		
E	Oil needed	1.58	A-D			
F	Target for Cup	3.67	C+E	Date :	3/8/2023	
G	Oil added to Cup	3.68	weigh	Time:	8:05	Init LH
H	Left in Cup	1.82	weigh	System Stable?:	yes	
I	Oil added to Jar	1.86	G-H			
J	Total Oil in Jar	67.78	D+I	3) Collection of WAF (after 6-hours settling)		
K	Oil needed	-0.28	A-(D+H)	Time:	14:15	Init PRM
L	Target for Cup	1.54	H+K	Solution ID:	23048	· SLN
M	Oil added to Cup		weigh			
N	Left in Cup		weigh			
O	Oil added to Jar	0.00	M-N			
P	Total Oil in Jar	67.78	J+O			
Q	Percent of Total	100.41%	((D+I+O)/A)*100			

Notes & Comments

① Cup is an aluminum foil (acetone rinsed) lined 5.5 oz Solo Cup or DM16 cup

Appendix C.

48 & 96-hour Acute Raw Data Sheets & Statistical Results for the **Definitive** Studies



Survival

Client:	Pegasus Technical Services, Inc.	
Code:	PEG-01	Job: 22218
Species:	Mysidopsis bahia	Code: MS
ID #:	2145	Age: 3d <input checked="" type="checkbox"/> Lab, <input type="checkbox"/> Com

Control Water:	SSW
Diluent:	SSW
Test Vessel:	500-mL Glass Jar
Test Volume:	200-mLs per replicate

Initiation Date:	5/10/23	Termination Date:	5/12/23
Sample Description:			
Product: Bryan Mound Oil WAF (25 gm/L)			
Test: Effect Concentration (EC)			

Sample Description	% WAF	REP	Live Counts		
			W	R	F
			0h	24h	48h
WAF	0	A	10	10	10
		B	10	10	10
		C	10	10	10
	6.25	A	10	10	10
		B	10	10	10
		C	10	10	10
	12.5	A	10	10	10
		B	10	10	10
		C	10	10	10
	25	A	10	10	10
		B	10	10	10
		C	10	10	10
	50	A	10	10	10
		B	10	10	10
		C	10	10	10
	100	A	10	64	6
		B	10	46	4
		C	10	84	8

pH			
(acceptable range for a valid test is 6 to 9)			
0h new	24h old solution	48h old solution	
8.2	7.8	7.9	
8.2	7.9	7.9	
8.2	8.0	8.0	
8.2	8.0	8.0	
8.2	8.0	7.9	
8.2	8.0	8.0	
436	436	436	
MC	MC	DM	

Dissolved Oxygen (mg/L)			
(acceptable minimum for a valid test is 4.0-mg/L)			
0h new	24h old solution	48h old solution	new
7.4	7.6	7.4	
7.4	7.5	7.2	
7.3	7.5	7.3	
7.3	7.4	7.4	
7.3	7.4	7.3	
7.2	7.4	7.2	
436	436	436	
MC	MC	DM	

Salinity (‰)			
(20±2‰, FedReg / Vol80, No14 / Jan2015)			
0h new	24h old solution	48h old solution	new
20.7	21.0	20.6	
20.7	20.9	20.8	
20.7	20.9	20.8	
20.6	20.8	20.7	
20.6	20.7	20.6	
20.5	20.7	20.7	
436	436	436	
MC	MC	DM	

Meter ID #:	X	X	X
Initials:	MC	MC	DM
Time:	1600	1510	1536
Control ID:	S982		
Diluent ID:	S982		
Working Stock ID:	23138 · SLN		
Oil ID ID:	22071 · CHM		
Randomization Template #	2		
Feeding Type:	Artemia (concentrated slurry)		
Amount:	2-drops (0.1-mL) 2-times, daily		
Time:	1600 1515 X		

Notes & Comments	
① 25.6 - MC 5/10	
② data entry error. the count at 24 hours for replicate "C" should be 8. In 11/1/23	

Photoperiod is 16L:8D, Illumination is ambient (50 to 100 fcd)

③ Check Box: Lab = In-House Reared, Com = Commercially obtained

Sample Description		Temperature (°C)		
		(acceptable range for a valid test is 25±1°C)		
		0	24	48
WAF	Control	25.6	25.5	25.5
	6.25	25.6	25.5	25.4
	12.5	25.6	25.6	25.6
	25	25.5	25.6	25.4
	50	25.6	25.6	25.4
Meter ID #:		426	425	426

CETIS Analytical Report

Report Date: 10 Jul-23 14:11 (p 1 of 2)

Test Code/ID: PEG-01 22218MSA / 18-1667-8004

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 00-6458-4846	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 10 Jul-23 14:11	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 10 Jul-23 14:10	MD5 Hash: DB26147371EC252DF1653D082A0ADFF1	Editor ID: 003-737-857-6
Batch ID: 20-5567-3677	Test Type: Survival (48h)	Analyst: Lab Tech
Start Date: 10 May-23 16:00	Protocol: EPA/821/R-02-012 (2002)	Diluent: Mod-Hard Synthetic Water
Ending Date: 12 May-23 15:36	Species: Mysidopsis bahia	Brine:
Test Length: 48h	Taxon: Malacostraca	Source: In-House Culture Age:
Sample ID: 19-9553-9355	Code: 76F1839B	Project: Product Toxicity Test
Sample Date: 08 Mar-23	Material: Product	Source: Pegasus Technical Services
Receipt Date: 08 Mar-23	CAS (PC):	Station: Fuel Oil WRD WAF
Sample Age: 63d 16h	Client: Pegasus	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1761206	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC50	>100	---	---

48h Survival Rate Summary

Calculated Variate(A/B)

Isotonic Variate

Conc-mg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	D	3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
6.25		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
12.5		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
25		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
50		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
100		3	0.6000	0.6000	0.4000	0.8000	33.33%	40.00%	18/30	0.6000	40.00%

48h Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000
100		0.6000	0.4000	0.8000

48h Survival Rate Binomials

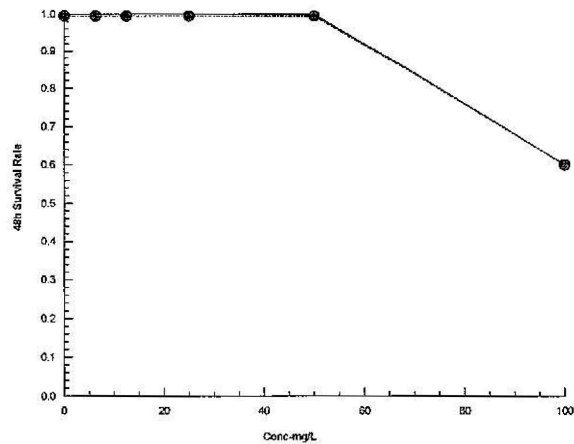
Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	10/10	10/10	10/10
6.25		10/10	10/10	10/10
12.5		10/10	10/10	10/10
25		10/10	10/10	10/10
50		10/10	10/10	10/10
100		6/10	4/10	8/10

CETIS Analytical Report

Report Date: 10 Jul-23 14:11 (p 2 of 2)
Test Code/ID: PEG-01 22218MSA / 18-1667-8004

Reference Toxicant 96-h Acute Survival Test			Hydrosphere Research	
Analysis ID: 00-6458-4846	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.7		
Analyzed: 10 Jul-23 14:11	Analysis: Linear Interpolation (ICPIN)	Status Level: 1		
Edit Date: 10 Jul-23 14:10	MD5 Hash: DB26147371EC252DF1653D082A0ADFF1	Editor ID: 003-737-857-6		

Graphics





Client: Pegasus Technical Services, Inc.

Code: PEG-01 Job: 22218

Species: *Menidia beryllina* Code: SS

ID #: 2138 Age: 12d ☐ Lab ☒ Com

Control Water: SSW

Diluent: SSW

Test Vessel: 1-L Glass Jar

Test Volume: 200-mLs per replicate

Initiation Date: 5.10.23 Termination Date: 5.14.23

Sample Description:

Product: Bryan Mound Oil WAF (25 gm/L)

Test : Effect Concentration (EC)

Sample Description	%	REP	Live Counts				
			W	R	F	S	S
Control	0	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	10	10
WAF	6.25	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	10	10
	12.5	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	10	10
	25	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	10	10
	50	A	10	10	10	10	10
		B	10	10	10	10	10
		C	10	10	10	10	10
	100	A	10	7	6	6	6
		B	10	7	7	7	7
		C	10	7	7	7	7

pH				
(acceptable range for a valid test is 6 to 9)				
0 new	24 old solution	48 old solution	72 old solution	96 old
8.2	8.0	8.0	8.1	8.1
8.2	8.0	7.5	8.2	8.1
8.2	8.0	7.9	8.2	8.1
8.2	7.9	7.9	8.2	8.0
8.2	8.0	8.1	8.2	8.0
8.2	8.0	8.0	8.2	8.0

Dissolved Oxygen (mg/L)				
(acceptable minimum for a valid test is 4.0-mg/L)				
0 new	24 old solution	48 old solution	72 old solution	96 old
7.4	7.5	7.5	7.3	7.4
7.4	7.5	7.4	7.3	7.4
7.3	7.5	7.3	7.2	7.5
7.3	7.5	7.1	7.3	7.5
7.3	7.4	7.2	7.3	7.4
7.2	7.4	7.2	7.2	7.4

Salinity (‰)				
(20±2‰; FedReg / Vol80, No14 / Jan2015)				
0 new	24 old solution	48 old solution	72 old solution	96 old
20.7	21.0	20.7	20.8	20.7
20.7	20.9	20.9	20.8	21.0
20.7	20.8	20.8	21.1	20.8
20.6	20.8	20.7	20.9	20.9
20.6	20.8	20.9	20.7	20.9
20.5	20.7	20.7	21.0	21.2

Meter ID #: X X 436 X X

Initials: PM ML DM DM PM

Time: 11:00 15:00 15:10 11:45 15:50

Control ID: 5982

Diluent ID: 5982

Working Stock ID: 23138 SLN

Oil ID ID: 22071 CHM

Randomization Template #: 2

Feeding Type: Artemia (concentrated slurry)

Amount: none

Time: ☒

Notes & Comments

① 8.0 PM 5/12/23

Photoperiod is 16L:8D, Illumination is ambient (50 to 100 fcd)

① Check Box: Lab = In-House Reared, Com = Commercially obtained

Sample Description	% WAF
Control	0
WAF	6.25
	12.5
	25
	50
	100

Meter ID #:

Temperature (°C)				
(acceptable range for a valid test is 25±1°C)				
0	24	48	72	96
25.6	25.5	25.5	25.3	25.7
25.6	25.6	25.4	25.3	25.8
25.5	25.6	25.4	25.3	25.7
25.6	25.5	25.4	25.3	25.7
25.6	25.6	25.4	25.3	25.7
25.5	25.6	25.4	25.3	25.7
42.6	42.5	42.6	42.5	42.5

CETIS Analytical Report

Report Date: 10 Jul-23 13:39 (p 1 of 2)

Test Code/ID: PEG-01 22218SSA / 07-7018-8638

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 11-2930-8763	Endpoint: 96h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 10 Jul-23 13:39	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 10 Jul-23 13:38	MD5 Hash: E37159E96EC4282E5B6BD6931244B90C	Editor ID: 003-737-857-6
Batch ID: 09-2954-8760	Test Type: Survival (96h)	Analyst: Lab Tech
Start Date: 10 May-23 16:00	Protocol: EPA/821/R-02-012 (2002)	Diluent: Synthetic Saltwater
Ending Date: 14 May-23 15:50	Species: Menidia beryllina	Brine:
Test Length: 96h	Taxon: Actinopterygii	Source: In-House Culture Age:
Sample ID: 01-7230-7040	Code: A453260	Project: Product Toxicity Test
Sample Date: 08 Mar-23	Material: Product	Source: Pegasus Technical Services
Receipt Date: 08 Mar-23	CAS (PC):	Station: Bryan Mound Oil WAF (25gm/L)
Sample Age: 63d 16h	Client: Pegasus	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1733420	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

TAC Limits

Attribute	Test Stat	Lower	Upper	Overlap	Decision
Control Resp	1	0.9	>>	Yes	Passes Criteria

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC50	>100	---	---

96h Survival Rate Summary

Calculated Variate(A/B)

Isotonic Variate

Conc-mg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	D	3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
6.25		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
12.5		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	1.0000	0.00%
25		3	0.9667	1.0000	0.9000	1.0000	5.97%	3.33%	29/30	0.9833	1.67%
50		3	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	30/30	0.9833	1.67%
100		3	0.6667	0.7000	0.6000	0.7000	8.66%	33.33%	20/30	0.6667	33.33%

96h Survival Rate Detail

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000
25		1.0000	1.0000	0.9000
50		1.0000	1.0000	1.0000
100		0.6000	0.7000	0.7000

96h Survival Rate Binomials

Conc-mg/L	Code	Rep 1	Rep 2	Rep 3
0	D	10/10	10/10	10/10
6.25		10/10	10/10	10/10
12.5		10/10	10/10	10/10
25		10/10	10/10	9/10
50		10/10	10/10	10/10
100		6/10	7/10	7/10

CETIS Analytical Report

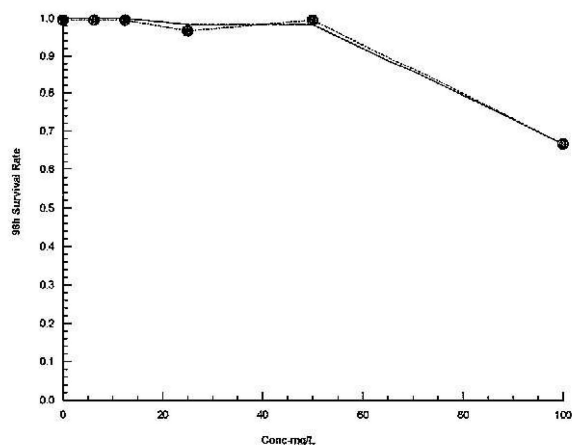
Report Date: 10 Jul-23 13:39 (p 2 of 2)
Test Code/ID: PEG-01 22218SSA / 07-7018-8638

Reference Toxicant 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 11-2930-8763	Endpoint: 96h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 10 Jul-23 13:39	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 10 Jul-23 13:38	MD5 Hash: E37159E96EC4282E5B6BD6931244B90C	Editor ID: 003-737-857-6

Graphics



Client: Pegasus Technical Services Code: PEG-01 Job: 22218

Task Title: 25 gm/L WAF prep Task Page 1 of 2

1) Product Name: Bryan Mound Oil Tech Initials: PRM

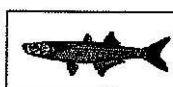
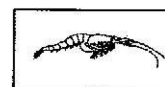
2) Lab ID: 22071 · CHM Date: 5/9/2023

OIL ~ WAF Preparation (Effective Concentration Test)			
oil mass for WAF		25	g/L
Saltwater Tests			
%	SS 600	MS 600	Both 1200
6.25	37.5	37.5	75
12.5	75	75	150
25	150	150	300
50	300	1800	600
100	600	300	1200
Bioassay WAF (mLs)	1162.5	2362.5	2325
Number of renewals	1		
WAF for renewals (mL)	2325		
Oil chem for WAF	1000		
BTEX for WAF	80		
Total WAF (mL)	3405		
Rounded	3500		
Mass of Oil (gm)	87.5		

Glass Cylinder (OD)			
7	diameter (in)	17.2	cm (width) Item 1
7	height (in)	17.3	cm (height) Item 2
17.78	height (cm)	4.0	L (volume) Item 3

OIL ~ WAF			
OIL ~ WAF Preparation (Effective Concentration Test)			
Saltwater SS & MS			
Item 4	WAF needed	3500	mLs
Item 5	Cylinder	4019.7	mLs
Item 6	WAF height	15.06	cm (from inside bottom, up)
Item 7	height+20%	18.08	cm (from inside bottom, up)
Item 8	cover ht of	17.3	cm (from inside bottom, up)
Item 9	is what %?	14.8	% (shoot for 20%)
Item 10	20% vortex	12.05	cm (from inside bottom, up)
OIL			
from "Mass of Oil (gms)"			
Item 11	Oil needed	87.5	~ mLs
Item 12	Diameter	17.20	cm
Item 13	Oil thickness	0.38	cm

Labor Hours to perform tasks on this page: NA


Client: **Pegasus Technical Services** Code: **PEG-01** Job: **22218**

Task Title **25 gm/L WAF prep** Task Page 2 of 2

1) Product Name: **Bryan Mound Oil** Tech Initials: **PRM**

2) Lab ID: **22071** · CHM Date: **5/9/2023**
WAF Mixture

Oil Mass:		25	gms/L		1) Initiation 18-hours of Mixing on Stir Plate (Target					
Oil ID:		22071	· CHM		is to achieve a 20% vortex)					
Water Volume:		3.50	L							
Water ID:		5976		SSW	Date :		5/9/2023			
Product (unit/L):		NA	units	gm	Time:		14:26		Init	PRM
Product ID:		NA	· CHM		Product Target:		#VALUE!		units	gm
Event		Mass (gms)	Action		Product added :				units	gm
A	Oil Needed	87.5	Tare Cup		Time:		NA		Init	NA
B	Add Oil to Cup ①	90.20	weigh		Vortex Height:		15			%
C	Left in Cup	2.50	weigh							
D	Total Oil in Jar	87.70	B-C		2) Terminate Mixing (at 18-hours)					
E	Oil needed	-0.20	A-D							
F	Target for Cup	2.30	C+E		Date :		5/10/2023			
G	Oil added to Cup		weigh		Time:		8:25		Init	PRM
H	Left in Cup		weigh		System Stable?:		yes			
I	Oil added to Jar	0.00	G-H							
J	Total Oil in Jar	87.70	D+I		3) Collection of WAF (after 6-hours settling)					
K	Oil needed	-0.20	A-(D+H)		Time:		14:30		Init	PRM
L	Target for Cup	-0.20	H+K		Solution ID:		23138		· SLN	
M	Oil added to Cup		weigh							
N	Left in Cup		weigh							
O	Oil added to Jar	0.00	M-N							
P	Total Oil in Jar	87.70	J+O							
Q	Percent of Total	100.23%	((D+I+O)/A)*100							

Notes & Comments

① Cup is an aluminum foil (acetone rinsed) lined 5.5 oz Solo Cup or DM16 cup

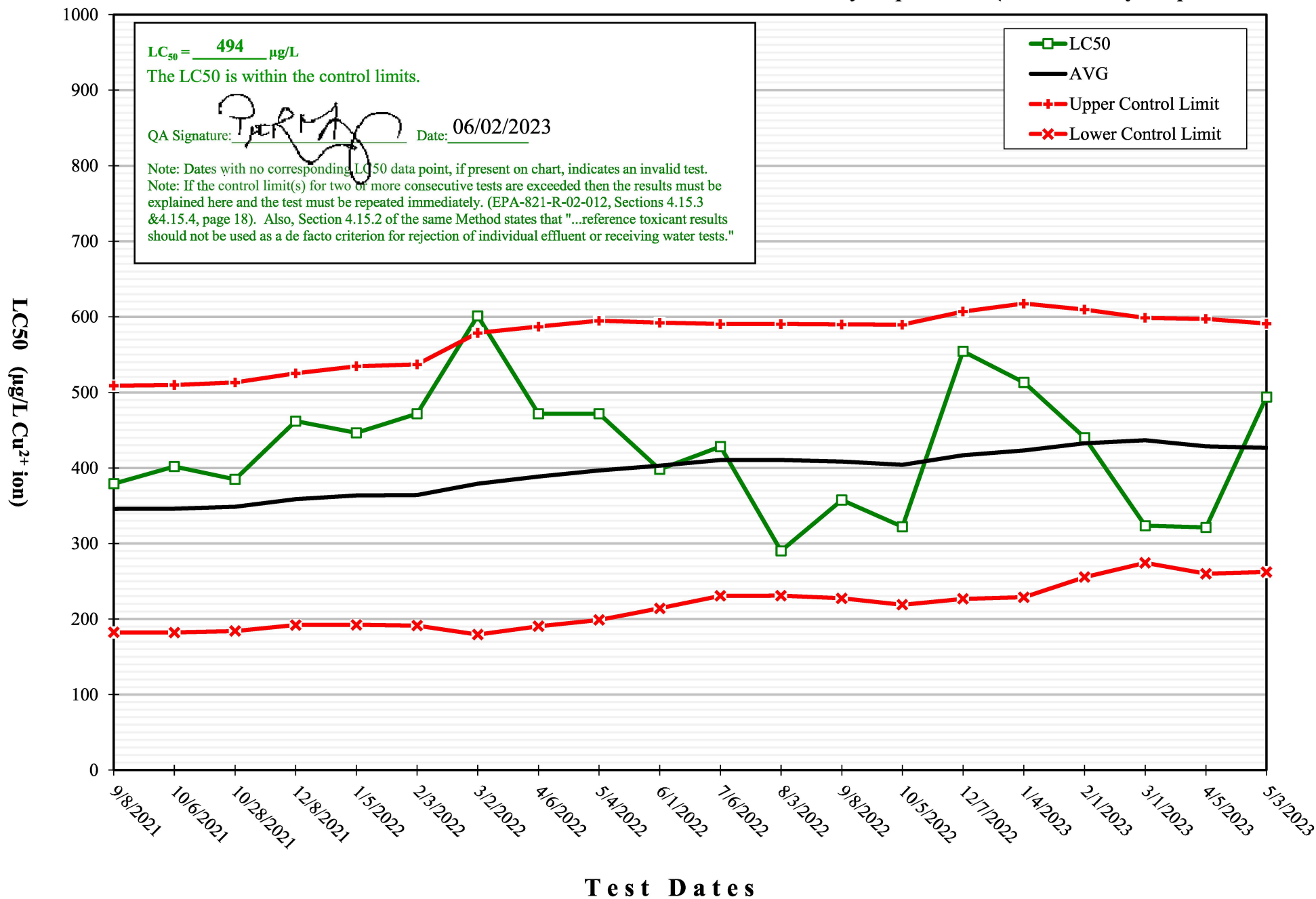
Appendix D.

Reference Toxicant Data for All Test Species



Control Chart-I

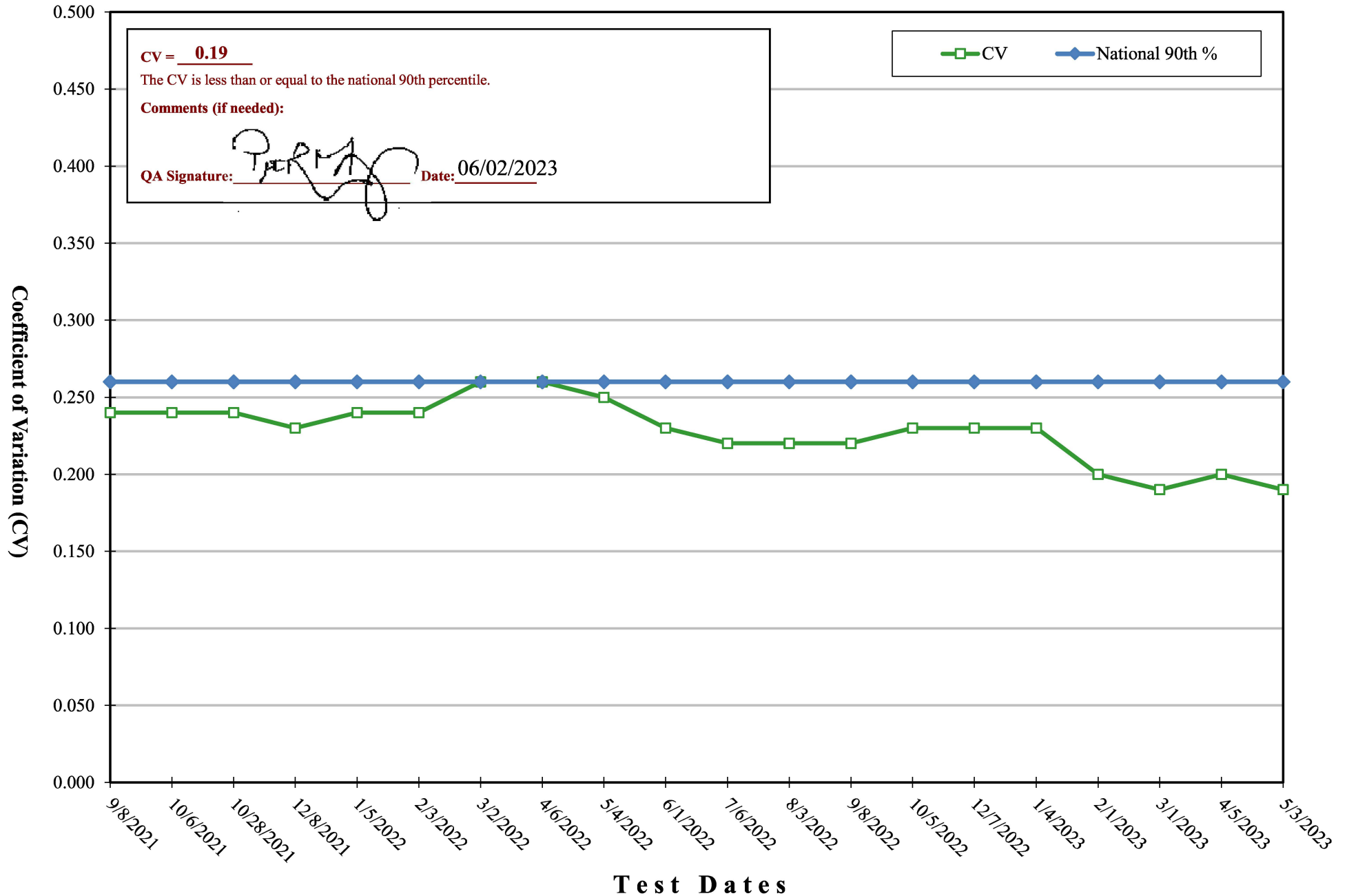
Control Limits for Standard Reference Toxicant Tests
ACUTE ... *Mysidopsis bahia* (cultured at Hydrosphere Research)





Control Chart - II

Coefficient of Variation for Standard Reference Toxicant Tests
ACUTE ... *Mysidopsis bahia* (cultured at Hydrosphere Research)



REFERENCE TOXICANT LOG • Last 20

Test: 48-hour Acute

Species: *Mysidopsis bahia*

Vendor: Hydrosphere Research

Toxicant: Copper Sulfate (µg Cu / L)



N	DATE	LC50	AVG	S.D.	2 SD	+ 2 SD.	- 2 SD	CV	National 75th %	National 90th %	Lower Control Limit	Upper Control Limit
437	9/8/2021	379	345.69	81.66	163.32	509.01	182.37	0.24	0.26	0.26	182.37	509.01
438	10/6/2021	402	346.03	81.89	163.78	509.81	182.25	0.24	0.26	0.26	182.25	509.81
439	10/28/2021	385	348.61	82.29	164.57	513.18	184.03	0.24	0.26	0.26	184.03	513.18
440	12/8/2021	462	358.63	83.33	166.66	525.28	191.97	0.23	0.26	0.26	191.97	525.28
441	1/5/2022	446	363.45	85.56	171.12	534.57	192.33	0.24	0.26	0.26	192.33	534.57
442	2/3/2022	472	364.17	86.44	172.88	537.05	191.28	0.24	0.26	0.26	191.28	537.05
443	3/2/2022	601	379.22	99.85	199.69	578.91	179.52	0.26	0.26	0.26	179.52	578.91
444	4/6/2022	472	388.70	99.13	198.26	586.95	190.44	0.26	0.26	0.26	190.44	586.95
445	5/4/2022	472	396.73	99.01	198.02	594.74	198.71	0.25	0.26	0.26	198.71	594.74
446	6/1/2022	398	403.09	94.48	188.96	592.05	214.12	0.23	0.26	0.26	214.12	592.05
447	7/6/2022	428	410.58	89.90	179.79	590.37	230.79	0.22	0.26	0.26	230.79	590.37
448	8/3/2022	290	410.61	89.86	179.72	590.33	230.88	0.22	0.26	0.26	230.88	590.33
449	9/8/2022	357	408.65	90.61	181.21	589.86	227.43	0.22	0.26	0.26	227.43	589.86
450	10/5/2022	322	404.18	92.64	185.28	589.46	218.89	0.23	0.26	0.26	218.89	589.46
451	12/7/2022	554	416.87	95.05	190.10	606.97	226.77	0.23	0.26	0.26	226.77	606.97
452	1/4/2023	513	423.17	97.14	194.28	617.45	228.89	0.23	0.26	0.26	228.89	617.45
453	2/1/2023	440	432.54	88.48	176.97	609.50	255.57	0.20	0.26	0.26	255.57	609.50
454	3/1/2023	323	436.51	81.05	162.10	598.60	274.41	0.19	0.26	0.26	274.41	598.60
455	4/5/2023	321	428.56	84.28	168.57	597.13	259.99	0.20	0.26	0.26	259.99	597.13
456	5/3/2023	494	426.61	82.16	164.32	590.93	262.28	0.19	0.26	0.26	262.28	590.93

SRT **Standard Reference Toxicant Test** Job # **May 2023**

Toxicant **Copper; Cu²⁺, desiccated** Benchsheet Set # for this Job (Unique combination of Sample + Method) **1**

Stock Solution **100 mg/L** Test Concentration **µg/L** Set page **1** of **1**

Document **Acute Saltwater Method (EPA-821-R-02-012)**

Species **Mysidopsis bahia** Code **MS** Method # **2007.0** SOP # **TST-003**

Feeding **Artemia Nauplii; Concentrate** Rate Fed **2-drops (0.1-mL) 2-times, daily**

Control Water **SSW** Synthetic Seawater Exposure Volume **200 mLs** Test Vessel Type **Plastic Cup; DM16**

Day 0 ~ Start Date **5/3/23** **W** day Note: Test Salinity is **20‰ !!!**

mLs of Copper ↑ 400mLs w/ SSW **NA** **0.22** **0.44** **0.88** **1.76** **3.52** Note: CASCADE is 7.04mLs ↑ 800mLs !!!

Dilution # **1** **2** **3** **4** **5** **6** Control / Diluent ID **5976**

Toxicant (µg/L) **Control** **55** **110** **220** **440** **880** Toxicant ID **23089-SLN**

NEW Solutions

pH (S.I.) **7.9** **8.0** **8.0** **8.0** **8.0** **8.0** pH Meter ID **421**

Dissolved Oxygen (mg/L) **8.6** **8.7** **8.6** **8.7** **8.7** **8.7** D.O. Meter ID **↓**

Salinity (‰) **20.5** **20.6** **20.5** **20.5** **20.5** **20.4** Cond. Meter ID **↓**

Live Counts; Replicate A **10** **10** **10** **10** **10** **10** WQ Initials **DM**

Live Counts; Replicate B **10** **10** **10** **10** **10** **10** WQ Time **12:27**

Stocking Initials **DM** Time **16:15** Age **2d** ID# **2137** Randomization # **1**

Feedings (Time) **5d** **am 5/3** **16:15** Evening **2-drops (0.1-mL) 2-times, daily**

Day 1 (24 hours) ~ Date **5/4/23** **R** day

Dilution # **1** **2** **3** **4** **5** **6** Control / Diluent ID **NA**

% Sample **Control** **55** **110** **220** **440** **880** Effluent ID **NA**

OLD Solutions

Temperature (°C) **25.1** **25.1** **25.0** **25.0** **24.9** **24.9** Thermometer ID **426**

pH (S.I.) **7.6** **7.8** **7.8** **7.9** **7.9** **7.9** pH Meter ID **421**

Dissolved Oxygen (mg/L) **8.5** **8.5** **8.4** **8.4** **8.4** **8.4** D.O. Meter ID **↓**

Salinity (‰) **21.6** **21.6** **21.8** **21.8** **21.8** **21.7** Cond. Meter ID **↓**

Live Counts; Replicate A **10** **10** **10** **10** **10** **9'** Count & WQ Initials **DM**

Live Counts; Replicate B **10** **10** **10** **10** **10** **10** Count & WQ Time **11:28**

Feedings (Time) **09:45** Morning **16:45** Evening **2-drops (0.1-mL) 2-times, daily**

Day 2 (48 hours) ~ End Date **5/5/23** **F** day Note: terminate test ±30 minutes of time initiated !!!

Dilution # **1** **2** **3** **4** **5** **6** Control / Diluent ID **NA**

% Sample **Control** **55** **110** **220** **440** **880** Effluent ID **NA**

OLD Solutions

Temperature (°C) **25.3** **25.2** **24.7** **24.7** **24.7** **24.7** Thermometer ID **426**

pH (S.I.) **7.7** **7.9** **7.9** **7.9** **7.9** **7.9** pH Meter ID **421**

Dissolved Oxygen (mg/L) **8.4** **8.0** **8.0** **8.0** **8.0** **8.0** D.O. Meter ID **↓**

Salinity (‰) **23.0** **22.9** **23.5** **23.5** **23.4** **23.4** Cond. Meter ID **↓**

Live Counts; Replicate A **10** **10** **10** **10** **6'** **0'** Count & WQ Initials **DM**

Live Counts; Replicate B **10** **10** **9'** **9'** **6'** **0'** Count & WQ Time **15:45**

Feedings (Time) **09:50** Morning **2-drops (0.1-mL) 2-times, daily**

Notes & Comments

① 18:00 DM 5/4/23 ③ 24.7, 24.7 DM 5/5/23

② 24.7, 7.9, 7.9, 23.1, 2', 4'

CETIS Analytical Report

 Report Date: 11 May-23 10:38 (p 1 of 2)
 Test Code/ID: MAY23 MSA2 / 11-1922-4565

Mysidopsis 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 18-5334-1020
 Analyzed: 11 May-23 10:37
 Edit Date: 11 May-23 10:37

✓Endpoint: 48h Survival Rate
 Analysis: Linear Interpolation (ICPIN)
 MD5 Hash: 9B2A474FF6E2D34D2D5E846A9C7135DE

CETIS Version: CETISv1.9.7
 Status Level: 1
 Editor ID: 003-737-857-6

Batch ID: 03-2515-4518
 Start Date: 03 May-23 16:15 ✓
 Ending Date: 05 May-23 15:45 ✓
 Test Length: 47h

Test Type: Survival (48h)
 Protocol: EPA/821/R-02-012 (2002)
 Species: Mysidopsis bahia ✓
 Taxon: Malacostraca

Analyst: Lab Tech
 Diluent: Synthetic Saltwater
 Brine: Tropic Marin
 Source: In-House Culture Age:

Sample ID: 02-8866-8015
 Sample Date: 03 May-23 16:15 ✓
 Receipt Date: 03 May-23 16:15 ✓
 Sample Age: ---

Code: 1134B96F
 Material: Copper sulfate ✓
 CAS (PC):
 Client: Internal Lab ✓

Project: Standard Reference Toxicant Test
 Source: Reference Toxicant
 Station: Aquatic Indicators

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	61400	200	Yes	Two-Point Interpolation

Point Estimates

Level	µg/L	95% LCL	95% UCL
LC50	493.9 ✓	493.9	493.9

48h Survival Rate Summary

Calculated Variate(A/B)

Isotonic Variate

Conc-µg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	D	2	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
55		2	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
110		2	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
220		2	0.9500	0.9500	0.9000	1.0000	7.44%	5.00%	19/20	0.9500	5.00%
440		2	0.6000	0.6000	0.6000	0.6000	0.00%	40.00%	12/20	0.6000	40.00%
880		2	0.0000	0.0000	0.0000	0.0000	---	100.00%	0/20	0.0000	100.00%

48h Survival Rate Detail

Conc-µg/L	Code	Rep 1	Rep 2
0	D	1.0000	1.0000
55		1.0000	1.0000
110		1.0000	1.0000
220		1.0000	0.9000
440		0.6000	0.6000
880		0.0000	0.0000

48h Survival Rate Binomials

Conc-µg/L	Code	Rep 1	Rep 2
0	D	10/10	10/10
55		10/10	10/10
110		10/10	10/10
220		10/10	9/10
440		6/10	6/10
880		0/10	0/10

CETIS Analytical Report

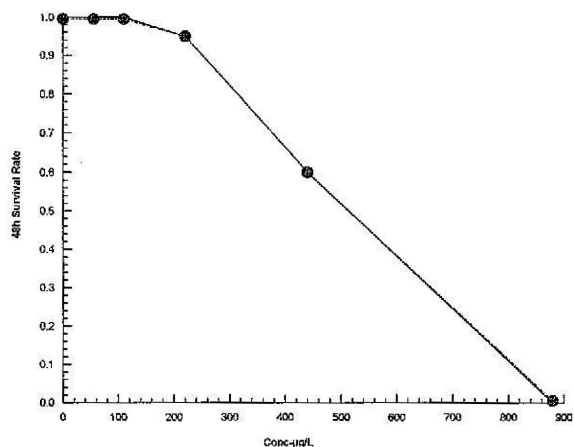
Report Date: 11 May-23 10:38 (p 2 of 2)
Test Code/ID: MAY23 MSA2 / 11-1922-4565

Mysidopsis 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 18-5334-1020	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 11 May-23 10:37	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 11 May-23 10:37	MD5 Hash: 9B2A474FF6E2D34D2D5E846A9C7135DE	Editor ID: 003-737-857-6

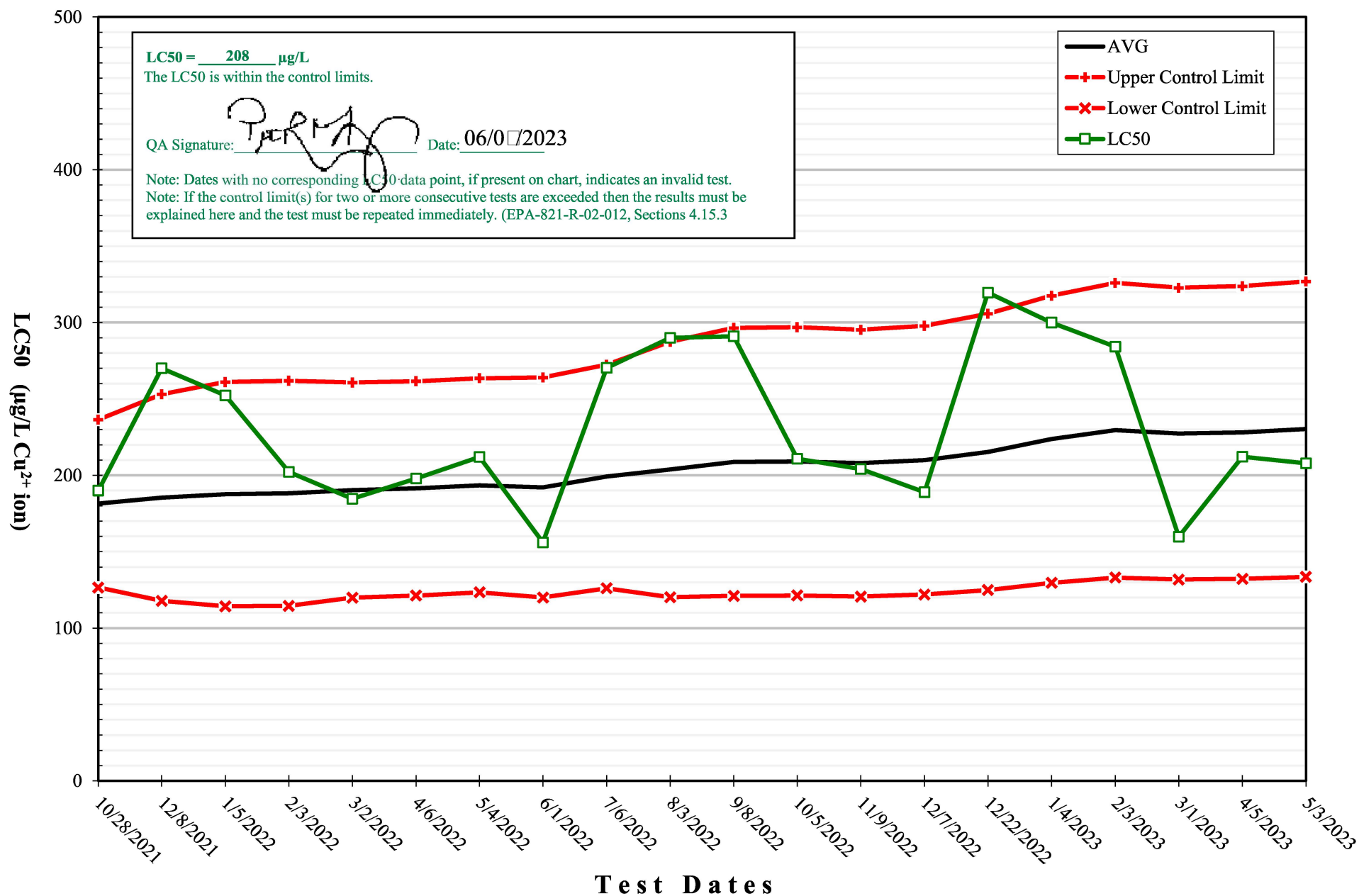
Graphics





Control Chart - I

Control Limits for Standard Reference Toxicant Tests
ACUTE ... *Menidia beryllina* (conducted by Hydrosphere Research)

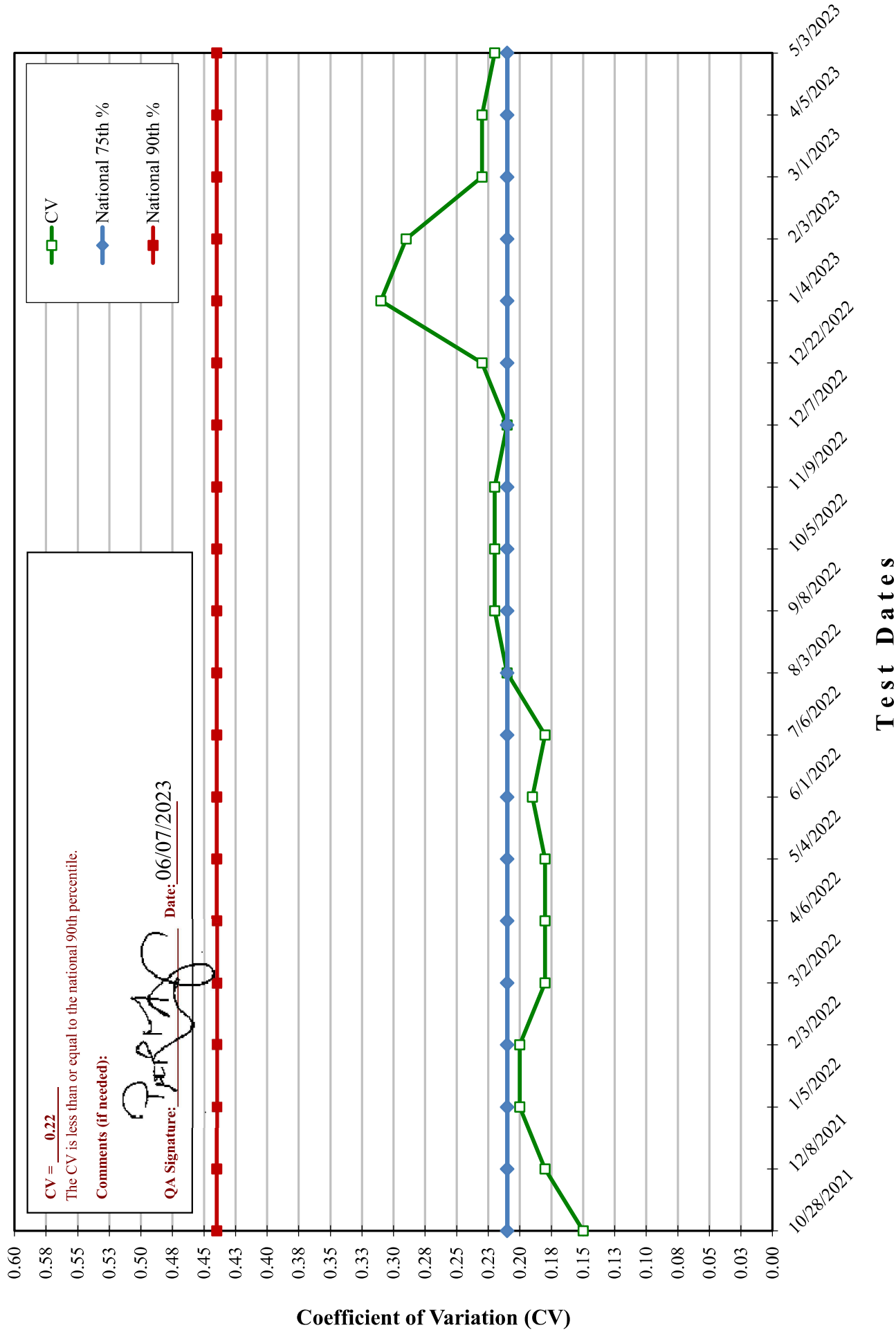





Control Chart - II

Coefficient of Variation for Standard Reference Toxicant Tests

ACUTE ... *Menidia beryllina* (conducted by Hydrosphere Research)



REFERENCE TOXICANT LOG • Last 20												
Test: 48-hour Acute Species: <i>Menidia beryllina</i> Vendor: Aquatic Indicators Toxicant: Copper Sulfate (µg Cu / liter)				Aquatic Indicators, Inc. 								
N	DATE	LC50	AVG	S.D.	2S.D.	+2S.D.	- 2 SD	CV	National 75th %	National 90th %	Lower Control Limit	Upper Control Limit
458	10/28/2021	190	182	27.44	54.89	236.41	126.63	0.15	0.21	0.44	126.63	236.41
459	12/8/2021	270	185	33.82	67.64	253.10	117.82	0.18	0.21	0.44	117.82	253.10
460	1/5/2022	252	188	36.69	73.38	261.04	114.27	0.20	0.21	0.44	114.27	261.04
461	2/3/2022	202	188	36.83	73.66	261.87	114.55	0.20	0.21	0.44	114.55	261.87
462	3/2/2022	185	190	35.21	70.43	260.77	119.92	0.18	0.21	0.44	119.92	260.77
463	4/6/2022	198	191	35.06	70.12	261.61	121.37	0.18	0.21	0.44	121.37	261.61
464	5/4/2022	212	193	35.03	70.06	263.55	123.43	0.18	0.21	0.44	123.43	263.55
465	6/1/2022	156	192	35.98	71.97	264.02	120.09	0.19	0.21	0.44	120.09	264.02
466	7/6/2022	270	199	36.57	73.14	272.38	126.11	0.18	0.21	0.44	126.11	272.38
467	8/3/2022	290	204	41.81	83.62	287.48	120.23	0.21	0.21	0.44	120.23	287.48
468	9/8/2022	291	209	45.97	91.94	300.79	116.90	0.22	0.21	0.44	121.13	296.56
469	10/5/2022	211	209	45.96	91.93	301.07	117.22	0.22	0.21	0.44	121.30	296.98
470	11/9/2022	204	208	45.77	91.54	299.53	116.44	0.22	0.21	0.44	120.63	295.34
471	12/7/2022	189	210	43.97	87.93	297.87	122.00	0.21	0.21	0.44	122.00	297.87
472	12/22/2022	320	215	50.34	100.68	315.99	114.62	0.23	0.21	0.44	124.88	305.73
473	1/4/2023	300	224	69.52	139.04	362.69	84.62	0.31	0.21	0.44	129.72	317.59
474	2/3/2023	284	230	67.65	135.31	364.87	94.25	0.29	0.21	0.44	133.15	325.98
475	3/1/2023	160	227	51.79	103.58	330.88	123.72	0.23	0.21	0.44	131.84	322.77
476	4/5/2023	212	228	51.43	102.86	330.93	125.20	0.23	0.21	0.44	132.28	323.85
478	5/3/2023	208	230	49.52	99.04	329.25	131.16	0.22	0.21	0.44	133.52	326.90



SRT

Standard Reference Toxicant Test

Job #

May 2023

Toxicant

Copper; Cu²⁺, desiccatedBenchsheet Set # for this Job
(Unique combination of Sample : Method)

1

Stock Solution

100 mg/L

Test Concentration

µg/L

Set page

1

of

1

Document	Acute Saltwater Method (EPA-821-R-02-012)						
Species	<i>Menidia beryllina</i>	Code	SS	Method #	2006.0	SOP #	TST-004
Feeding	Artemia Nauplii; Concentrate		Rate Fed	0.2 mL/s; 2-hours prior to test solution renewal			
Control Water	SSW	Synthetic Seawater	Exposure Volume	200 mLs	Test Vessel Type	Plastic Cup; DM32	

Day 0 ~ Start Date	5/3/23	W	day	Note: Test Salinity is 20‰ !!!			
mLs of Copper ↑ 400mLs w/ SSW	NA	0.3	0.6	1.2	2.4	4.8	Note: CASCADE is 9.6mLs ↑ 800mLs !!!
Dilution #	1	2	3	4	5	6	Control / Diluent ID
Toxicant (µg/L)	Control	75	150	300	600	1,200	Toxicant ID
pH (S.I.)	7.9	8.0	8.0	8.0	8.0	8.0	pH Meter ID
Dissolved Oxygen (mg/L)	8.6	8.7	8.7	8.6	8.6	8.7	D.O. Meter ID
Salinity (‰)	20.5	20.5	20.5	20.5	20.4	20.3	Cond. Meter ID

Live Counts; Replicate A	10	10	10	10	10	10	WQ Initials	DM
Live Counts; Replicate B	10	10	10	10	10	10	WQ Time	12:33
Stocking Initials	UH	Time	15:50	Age	12/00	ID#	2130	Randomization #
								1

Day 1 (24 hours) ~ Date	5/4/23	R	day						
Dilution #	1	2	3	4	5	6	Control / Diluent ID	NA	
% Sample	Control	75	150	300	600	1200	Effluent ID	NA	
Temperature (°C)	25.3	25.3	25.3	25.3	25.3	25.1	Thermometer ID	426	
pH (S.I.)	7.6	7.8	7.9	7.9	7.9	7.9	pH Meter ID	421	
Dissolved Oxygen (mg/L)	7.8	7.6	7.7	7.6	7.7	7.8	D.O. Meter ID		
Salinity (‰)	21.4	21.5	21.6	21.6	21.5	21.4	Cond. Meter ID		
Live Counts; Replicate A	10	10	10	3 ⁷	1 ⁹	0 ¹⁰	Count & WQ Initials	DM	
Live Counts; Replicate B	10	10	10	4 ⁶	3 ⁷	0 ¹⁰	Count & WQ Time	11:32	

Day 2 (48 hours) ~ End Date	5/5/23	F	day	Note: terminate test ±30 minutes of time initiated !!!					
Dilution #	1	2	3	4	5	6	Control / Diluent ID	NA	
% Sample	Control	75	150	300	600	1200	Effluent ID	NA	
Temperature (°C)	25.3	25.3	25.2	25.0	25.1		Thermometer ID	426	
pH (S.I.)	7.6	7.8	7.8	7.9	7.9		pH Meter ID	421	
Dissolved Oxygen (mg/L)	7.8	7.6	7.5	7.5	7.6		D.O. Meter ID		
Salinity (‰)	22.4	22.4	22.7	22.9	22.8		Cond. Meter ID		
Live Counts; Replicate A	10	10	10	1 ²	0 ¹		Count & WQ Initials	DM	
Live Counts; Replicate B	10	10	8 ²	0 ⁴	0 ³		Count & WQ Time	15:30	

Notes & Comments

011 days UH 5:15

CETIS Analytical Report

 Report Date: 11 May-23 10:29 (p 1 of 2)
 Test Code/ID: MAY23 SSA / 09-6183-3342

Inland Silverside 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 10-4185-1005	Endpoint: 48h Survival Rate ✓	CETIS Version: CETISv1.9.7
Analyzed: 11 May-23 10:28	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 11 May-23 10:28	MD5 Hash: 965379A7651F65E1373BE05603FB5078	Editor ID: 003-737-857-6
Batch ID: 15-8077-9378	Test Type: Survival (48h)	Analyst: Lab Tech
Start Date: 03 May-23 15:50 ✓	Protocol: EPA/821/R-02-012 (2002)	Diluent: Synthetic Saltwater
Ending Date: 05 May-23 15:30 ✓	Species: Menidia beryllina ✓	Brine: Tropic Marin
Test Length: 48h	Taxon: Actinopterygii	Source: Aquatic Indicators, FL Age:
Sample ID: 02-3335-8766	Code: DE8C5AE ✓	Project: Standard Reference Toxicant Test
Sample Date: 03 May-23 15:50 ✓	Material: Copper sulfate ✓	Source: Reference Toxicant
Receipt Date: 03 May-23 15:50 ✓	CAS (PC):	Station: Aquatic Indicators
Sample Age: --	Client: Aquatic Indicators	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	819946	200	Yes	Two-Point Interpolation

Point Estimates

Level	µg/L	95% LCL	95% UCL
LC50	207.9	154.6	258.4

48h Survival Rate Summary

Calculated Variate(A/B)

Isotonic Variate

Conc-µg/L	Code	Count	Mean	Median	Min	Max	CV%	%Effect	A/B	Mean	%Effect
0	D	2	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
75		2	1.0000	1.0000	1.0000	1.0000	0.00%	0.00%	20/20	1.0000	0.00%
150		2	0.9000	0.9000	0.8000	1.0000	15.71%	10.00%	18/20	0.9000	10.00%
300		2	0.0500	0.0500	0.0000	0.1000	141.42%	95.00%	1/20	0.0500	95.00%
600		2	0.0000	0.0000	0.0000	0.0000	---	100.00%	0/20	0.0000	100.00%
1200		2	0.0000	0.0000	0.0000	0.0000	---	100.00%	0/20	0.0000	100.00%

48h Survival Rate Detail

Conc-µg/L	Code	Rep 1	Rep 2
0	D	1.0000	1.0000
75		1.0000	1.0000
150		1.0000	0.8000
300		0.1000	0.0000
600		0.0000	0.0000
1200		0.0000	0.0000

48h Survival Rate Binomials

Conc-µg/L	Code	Rep 1	Rep 2
0	D	10/10	10/10
75		10/10	10/10
150		10/10	8/10
300		1/10	0/10
600		0/10	0/10
1200		0/10	0/10

CETIS Analytical Report

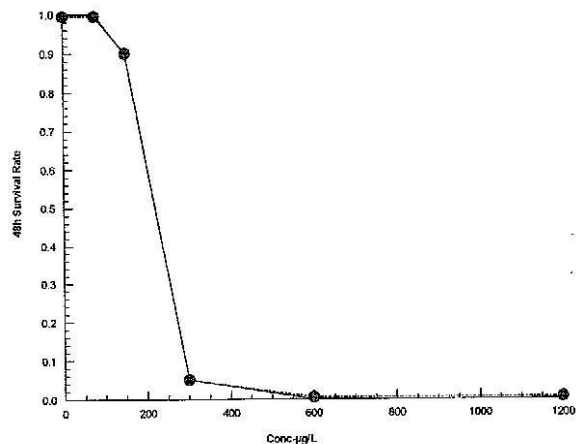
Report Date: 11 May-23 10:29 (p 2 of 2)
Test Code/ID: MAY23 SSA / 09-6183-3342

Inland Silverside 96-h Acute Survival Test

Hydrosphere Research

Analysis ID: 10-4185-1005	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.9.7
Analyzed: 11 May-23 10:28	Analysis: Linear Interpolation (ICPIN)	Status Level: 1
Edit Date: 11 May-23 10:28	MD5 Hash: 965379A7651F65E1373BE05603FB5078	Editor ID: 003-737-857-6

Graphics



APPENDIX 2

Pegasus Technical Services, Inc.

Bryan Mound Crude Oil

September 2022

Job: 15911



PEGASUS TECHNICAL SERVICES, INC.
26 WEST MARTIN LUTHER KING DRIVE
45268, Cincinnati
United States



Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number : 13072/00015911.1/L/23 Submitted date : 03-24-2023
Sample submitted at : Saybolt LP, Deer Park
Report Date : 05-31-2023 Date received : 03-24-2023
Date of issue : 05-31-2023 Date completed : 05-31-2023
Sample object : Pegasus Tech Svc Sample number : 14490450
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (Whole Oil)

NAME	METHOD	UNIT	RESULT
Gravity API at 60 °F	ASTM D 5002	*API	38.6
Relative Density at 60/60 °F	ASTM D 5002	-	0.8320
Asphaltenes	ASTM D 6560	mass %	0.48
Micro Carbon Residue	ASTM D 4530	mass %	2.11
UOP K factor	UOP 375	-	12.1
Organic chloride	ASTM D 4929		
Organic chloride in Naphtha fraction proc. B		µg/g	<1
Organic chloride in original sample		µg/g	<1
Hydrogen Sulfide and Mercaptan Sulphur	UOP 163		
Hydrogen Sulfide, as S		mg/kg	<1
Mercaptan, as S		mg/kg	14.5
Hydrogen Sulfide	ASTM D 5705	ppm	<1
Kinematic Viscosity at 77 °F	ASTM D 445	mm ² /s	4.721
Kinematic Viscosity at 100 °F	ASTM D 445	mm ² /s	3.547
Metals by ICP	ASTM D 5708		
Copper (Cu) Method B		mg/kg	< 0.1
Iron (Fe) - Method B		mg/kg	1.1
Nickel (Ni) - Method B		mg/kg	4.3
Vanadium (V) - Method B		mg/kg	8.7
Nitrogen	ASTM D 5762	WT%	0.0832
Pour Point	ASTM D 97	°C	-48
Salt Content	ASTM D 3230	WT%	0.00038
Sediment By Extraction	ASTM D 473	mass %	0.03
Sulphur (S)	ASTM D 4294	mass %	0.377
VPCR4 at 100 °F	ASTM D 6377	psi	6.54
Water Karl Fischer	ASTM D 4928	mass %	0.02
Wax content	UOP 46 obs.	mass %	3.6
Acid Number	ASTM D 664		
Acid number		mg KOH/g	0.23
Sample Size		g	6.69

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Attention of : Ms. D. Sundaravadevelu

Analysis Report

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Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 03-24-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-31-2023
Sample type	: Submitted	Sample number	: 14490450
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (Whole Oil)		

NAME	METHOD	UNIT	RESULT
Inflection or buffer endpoint		-	Inflection
Light Hydrocarbons in Crude Oil, Extended	ASTM D 7900 mod.		
Benzene		LV %	0.27
Toluene		LV %	0.60
Ethyl Benzene		LV %	0.14
M-Xylene		LV %	0.39
p-Xylene		LV %	0.12
o-Xylene		LV %	0.20
Simulated Distillation	ASTM D 7169		
IBP (0.5%)		°F	21
5% recovered		°F	138
10% recovered		°F	193
15% recovered		°F	236
20% recovered		°F	278
25% recovered		°F	327
30% recovered		°F	377
35% recovered		°F	428
40% recovered		°F	475
45% recovered		°F	520
50% recovered		°F	568
55% recovered		°F	614
60% recovered		°F	666
65% recovered		°F	720
70% recovered		°F	777
75% recovered		°F	830
80% recovered		°F	897
85% recovered		°F	978
90% recovered		°F	1085
95% recovered		°F	1242
FBP (99.5%)		°F	>1328
Boiling Range Residue		mass %	3.5

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Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (Whole Oil)

NAME	METHOD	UNIT	RESULT
Recovery		mass %	96.5

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Analysis Report

Report number : 13072/00015911.1/L/23 Submitted date : 03-24-2023
Sample submitted at : Saybolt LP, Deer Park
Report Date : 05-31-2023 Date received : 05-14-2023
Date of issue : 05-31-2023 Date completed : 05-14-2023
Sample object : Pegasus Tech Svc Sample number : 14586585
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (IBP-75°F)

NAME	METHOD	UNIT	RESULT
Yield, LV%	ASTM D 2892	LV %	3.16
Yield, LV%	ASTM D 2892	LV %	2.23
Gravity API at 60 °F	ASTM D 4052	°API	111.7
Relative Density at 60/60 °F	ASTM D 4052	-	0.5818
DHA Analysis	DHA		Attached

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number	: 13072/00015911.1/L/23	Submitted date	: 04-16-2023
Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 05-05-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-25-2023
Sample type	: Submitted	Sample number	: 14586586
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (75-175°F)		

NAME	METHOD	UNIT	RESULT
Yield, LV%	ASTM D 2892	LV %	8.32
Yield on crude	ASTM D 2892	vol %	6.76
Gravity API at 60 °F	ASTM D 4052	°API	79.6
Relative Density at 60/60 °F	ASTM D 4052	-	0.6702
DHA Analysis	DHA		Attached
Sulphur (S)	ASTM D 5453	Wt%	0.0013
Organic chloride	ASTM D 4929	ppm	<1
Hydrogen Sulfide and Mercaptan Sulphur	UOP 163		
Hydrogen Sulfide, as S		mg/kg	<1
Mercaptan, as S		mg/kg	11
Hydrogen Sulfide	ASTM D 5705	ppm	<1
Research Octane Number (RON)	ASTM D 2699	-	67
Motor Octane Number (MON)	ASTM D 2700	-	65
Simulated Distillation	ASTM D 2887		
IBP (0.5%)		°F	28
5% recovered		°F	70
10% recovered		°F	74
15% recovered		°F	90
20% recovered		°F	92
25% recovered		°F	94
30% recovered		°F	96
35% recovered		°F	98
40% recovered		°F	113
45% recovered		°F	132
50% recovered		°F	135
55% recovered		°F	140
60% recovered		°F	148
65% recovered		°F	157
70% recovered		°F	158
75% recovered		°F	159

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Date of issue : 05-31-2023 Date completed : 05-25-2023
Sample object : Pegasus Tech Svc Sample number : 14586586
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (75-175°F)

NAME	METHOD	UNIT	RESULT
80% recovered		°F	166
85% recovered		°F	169
90% recovered		°F	180
95% recovered		°F	187
FBP (99.5%)		°F	209
Boiling Range Residue		mass %	--

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Analysis Report

Report number	: 13072/00015911.1/L/23	Submitted date	: 03-24-2023
Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 05-05-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-25-2023
Sample type	: Submitted	Sample number	: 14586587
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (175-250°F)		

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 2892	vol %	10.22
Yield on crude	ASTM D 2892	mass %	9.14
API Gravity & Relative Density	ASTM D 4052		
API Gravity		-	60.5
Relative Density at 60/60°F		-	0.7371
PIANO	ASTM D 6733		
See Attached			See Attached
Sulphur (S)	ASTM D 5453	mg/kg	0.0018
Organic chloride	ASTM D 4929		
Organic chloride in original sample		µg/g	<1
Hydrogen Sulfide and Mercaptan Sulphur	UOP 163		
Hydrogen Sulfide, as S		mg/kg	<1
Mercaptan, as S		mg/kg	10
Hydrogen Sulfide	ASTM D 5705	ppm v/v	8
Research Octane Number (RON)	ASTM D 2699	-	55
Motor Octane Number (MON)	ASTM D 2700	-	56
Simulated Distillation	ASTM D 2887		
IBP (0.5%)		°F	132
5% recovered		°F	167
10% recovered		°F	185
15% recovered		°F	191
20% recovered		°F	196
25% recovered		°F	201
30% recovered		°F	205
35% recovered		°F	211
40% recovered		°F	213
45% recovered		°F	215
50% recovered		°F	221
55% recovered		°F	223
60% recovered		°F	224

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Date of issue : 05-31-2023
Date completed : 05-25-2023
Sample object : Pegasus Tech Svc
Sample number : 14586587
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (175-250°F)

NAME	METHOD	UNIT	RESULT
65% recovered		°F	229
70% recovered		°F	237
75% recovered		°F	241
80% recovered		°F	247
85% recovered		°F	251
90% recovered		°F	260
95% recovered		°F	264
FBP (99.5%)		°F	286

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Analysis Report

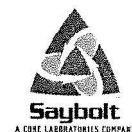
Report number	: 13072/00015911.1/L/23	Submitted date	: 04-16-2023
Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 05-05-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-25-2023
Sample type	: Submitted	Sample number	: 14586588
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (250-375°F)		

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 2892	vol %	13.87
Yield on crude	ASTM D 2892	mass %	13.05
API Gravity & Relative Density	ASTM D 4052		
API Gravity		-	51.0
Relative Density at 60/60°F		-	0.7755
PIANO	ASTM D 6733		
See Attached			See Attached
Organic chloride	ASTM D 4929		
Organic chloride in original sample		µg/g	<1
Hydrogen Sulfide and Mercaptan Sulphur	UOP 163		
Hydrogen Sulfide, as S		mg/kg	<1
Mercaptan, as S		mg/kg	26.4
Hydrogen Sulfide	ASTM D 5705	ppm v/v	60
Research Octane Number (RON)	ASTM D 2699	-	30
Motor Octane Number (MON)	ASTM D 2700	-	27
Aniline Point	ASTM D 611	°C	53.90
Elemental analysis	ASTM D 5291		
Carbon		mass %	85.89
Hydrogen		mass %	14.09
Naphthalenes	ASTM D 1840		
Naphthalenes procedure B		vol %	0.28
Smoke Point	ASTM D 1322	mm	23
Sulphur (S)	ASTM D 4294	mass %	0.0117
Simulated Distillation	ASTM D 2887		
IBP (0.5%)		°F	210
5% recovered		°F	247
10% recovered		°F	261
15% recovered		°F	273
20% recovered		°F	278
25% recovered		°F	286

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Date of issue : 05-31-2023 Date received : 05-05-2023
Sample object : Pegasus Tech Svc Date completed : 05-25-2023
Sample type : Submitted Sample number : 14586588
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (250-375°F)

NAME	METHOD	UNIT	RESULT
30% recovered		°F	290
35% recovered		°F	296
40% recovered		°F	305
45% recovered		°F	309
50% recovered		°F	314
55% recovered		°F	322
60% recovered		°F	328
65% recovered		°F	334
70% recovered		°F	340
75% recovered		°F	348
80% recovered		°F	351
85% recovered		°F	360
90% recovered		°F	370
95% recovered		°F	385
FDP (99.5%)		°F	406

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 05-05-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-31-2023
Sample type	: Submitted	Sample number	: 14586589
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (375-530°F)		

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 2892	vol %	15.96
Yield on crude	ASTM D 2892	mass %	15.77
API Gravity & Relative Density	ASTM D 4052		
API Gravity		-	40.6
Relative Density at 60/60°F		-	0.8221
Organic chloride	ASTM D 4929		
Organic chloride in original sample		µg/g	<1
Hydrogen Sulfide and Mercaptan Sulphur	UOP 163		
Hydrogen Sulfide, as S		mg/kg	<1
Mercaptan, as S		mg/kg	23
Hydrogen Sulfide	ASTM D 5705	ppm v/v	90
Aniline Point	ASTM D 611	°C	64.55
Elemental analysis	ASTM D 5291		
Carbon		mass %	85.87
Hydrogen		mass %	14.06
Naphthalenes	ASTM D 1840		
Naphthalenes procedure B		vol %	3.44
Smoke Point	ASTM D 1322	mm	17
Sulphur (S)	ASTM D 4294	mass %	0.0646
Acid Number	ASTM D 664		
Acid number		mg KOH/g	0.1
Sample Size			20.0155
Inflection or buffer endpoint		-	Inf
Cloud Point	ASTM D 2500	°C	-39
Freezing Point	ASTM D 2386	°C	-35.0
FIA (hydrocarbon types)	ASTM D 1319		
Saturates		vol %	81.9
Olefins		vol %	1.0
Aromatics		vol %	17.1
Kinematic Viscosity at 77 °F	ASTM D 445	mm ² /s	2.361

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United States



Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number : 13072/00015911.1/L/23 Submitted date : 03-24-2023
Sample submitted at : Saybolt LP, Deer Park
Report Date : 05-31-2023 Date received : 05-05-2023
Date of issue : 05-31-2023 Date completed : 05-31-2023
Sample object : Pegasus Tech Svc Sample number : 14586589
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (375-530°F)

NAME	METHOD	UNIT	RESULT
Kinematic Viscosity at 100 °F	ASTM D 445	mm ² /s	1.885
Total Nitrogen	ASTM D 4629	mg/kg	1.6
Pour Point ¹	ASTM D 97	°C	-41
UOP K factor	UOP 375	-	11.8
Cetane Index	ASTM D 976	-	47.8
Simulated Distillation	ASTM D 2887		

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Date of issue : 05-31-2023
Date completed : 05-31-2023
Sample object : Pegasus Tech Svc
Sample number : 14586589
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (375-530°F)

NAME	METHOD	UNIT	RESULT
IBP (0.5%)		°F	333
5% recovered		°F	377
10% recovered		°F	389
15% recovered		°F	402
20% recovered		°F	413
25% recovered		°F	423
30% recovered		°F	428
35% recovered		°F	438
40% recovered		°F	448
45% recovered		°F	455
50% recovered		°F	461
55% recovered		°F	469
60% recovered		°F	479
65% recovered		°F	487
70% recovered		°F	493
75% recovered		°F	499
80% recovered		°F	509
85% recovered		°F	516
90% recovered		°F	524
95% recovered		°F	536
FBP (99.5%)		°F	571

Remarks:

- 1 Derived from Spiral

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Date of issue : 05-31-2023 Date completed : 05-25-2023
Sample object : Pegasus Tech Svc Sample number : 14586590
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (530-650°F)

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 2892	vol %	12.16
Yield on crude	ASTM D 2892	mass %	12.50
API Gravity & Relative Density	ASTM D 4052		
API Gravity		-	34.0
Relative Density at 60/60°F		-	0.8549
Aniline Point	ASTM D 611	°C	76.70
Elemental analysis	ASTM D 5291		
Carbon		mass %	86.53
Hydrogen		mass %	13.22
Naphthalenes	ASTM D 1840		
Naphthalenes procedure B		vol %	7.83
Smoke Point	ASTM D 1322	mm	15
Sulphur (S)	ASTM D 4294	mass %	0.241
Acid Number	ASTM D 664		
Acid number		mg KOH/g	0.2
Sample Size			20.0080
Inflection or buffer endpoint		-	Inf
Cloud Point	ASTM D 2500	°C	14
Kinematic Viscosity at 130 °F	ASTM D 445	mm ² /s	3.498
Kinematic Viscosity at 100 °F	ASTM D 445	mm ² /s	5.188
Nitrogen	ASTM D 5762	WT%	0.0163
Pour Point	ASTM D 97	°C	-6
UOP K factor	UOP 375	-	11.8
Cetane Index	ASTM D 976	-	52.0
Simulated Distillation	ASTM D 2887		
IBP (0.5%)		°F	495
5% recovered		°F	532
10% recovered		°F	545
15% recovered		°F	553
20% recovered		°F	560

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Date of issue : 05-31-2023 Date received : 05-05-2023
Sample object : Pegasus Tech Svc Date completed : 05-25-2023
Sample type : Submitted Sample number : 14586590
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (530-650°F)

NAME	METHOD	UNIT	RESULT
25% recovered		°F	568
30% recovered		°F	574
35% recovered		°F	581
40% recovered		°F	584
45% recovered		°F	590
50% recovered		°F	597
55% recovered		°F	605
60% recovered		°F	609
65% recovered		°F	615
70% recovered		°F	623
75% recovered		°F	630
80% recovered		°F	635
85% recovered		°F	644
90% recovered		°F	652
95% recovered		°F	660
FBP (99.5%)		°F	695

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number : 13072/00015911.1/L/23 Submitted date : 04-16-2023
Sample submitted at : Saybolt LP, Deer Park
Report Date : 05-31-2023 Date received : 05-07-2023
Date of issue : 05-31-2023 Date completed : 05-31-2023
Sample object : Pegasus Tech Svc Sample number : 14586591
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (650°F plus)

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 2892	vol %	36.31
Yield on crude	ASTM D 2892	mass %	40.55
API Gravity & Relative Density	ASTM D 4052		
API Gravity ¹		-	20.8
Relative Density at 60/60°F ¹		-	0.9291
Acid Number	ASTM D 664		
Acid number		mg KOH/g	0.58
Sample Size		g	1.3233
Inflection or buffer Endpoint		-	Inf
Asphaltenes	ASTM D 6560	mass %	1.2
Micro Carbon Residue	ASTM D 4530	mass %	4.96
Kinematic Viscosity at 130 °F	ASTM D 445	mm ² /s	102.4
Kinematic Viscosity at 180 °F	ASTM D 445	mm ² /s	31.66
Metals by ICP	ASTM D 5708		
Iron (Fe) - Method B		mg/kg	0.4
Nickel (Ni) - Method B		mg/kg	10.2
Vanadium (V) - Method B		mg/kg	19.2
Metals by ICP	ASTM D 5708		
Copper (Cu) - Method B		mg/kg	< 0.1
Nitrogen	ASTM D 5762	WT %	0.2076
Pour Point	ASTM D 97	°C	24
Sulphur (S)	ASTM D 4294	mass %	0.824
Elemental analysis	ASTM D 5291		
Carbon		mass %	86.72
Hydrogen		mass %	12.26
Simulated Distillation	ASTM D 7169		
IBP (0.5%)		°F	639
5% recovered		°F	675
10% recovered		°F	699
15% recovered		°F	723

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Date received : 05-07-2023
Date of issue : 05-31-2023
Date completed : 05-31-2023
Sample object : Pegasus Tech Svc
Sample number : 14586591
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (650°F plus)

NAME	METHOD	UNIT	RESULT
20% recovered		°F	748
25% recovered		°F	772
30% recovered		°F	794
35% recovered		°F	818
40% recovered		°F	843
45% recovered		°F	871
50% recovered		°F	900
55% recovered		°F	932
60% recovered		°F	966
65% recovered		°F	1005
70% recovered		°F	1048
75% recovered		°F	1096
80% recovered		°F	1152
85% recovered		°F	1216
90% recovered		°F	1298
95% recovered		°F	---
FBP (99.5%)		°F	>1328
Boiling Range Residue		mass %	8.1
Recovery		mass %	91.9

Remarks:

1 by Calc.

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number	: 13072/00015911.1/L/23	Submitted date	: 03-24-2023
Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 05-07-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-31-2023
Sample type	: Submitted	Sample number	: 14586592
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (650-850°F)		

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 5236	vol %	15.60
Yield on crude	ASTM D 5236	mass %	16.77
API Gravity & Relative Density	ASTM D 4052		
API Gravity		-	26.7
Relative Density at 60/60°F		-	0.8947
Aniline Point	ASTM D 611	°C	87.65
Elemental analysis	ASTM D 5291		
Carbon		mass %	86.53
Hydrogen		mass %	12.94
Sulphur (S)	ASTM D 4294	mass %	0.464
Acid Number	ASTM D 664		
Acid number		mg KOH/g	0.38
Sample Size		g	4.0534
inflection or buffer endpoint		-	Inf
Cloud Point ¹	ASTM D 2500	°C	28.6
Kinematic Viscosity at 130 °F	ASTM D 445	mm ² /s	14.72
Kinematic Viscosity at 180 °F	ASTM D 445	mm ² /s	6.736
Nitrogen	ASTM D 5762	WT%	0.0684
Pour Point	ASTM D 97	°C	24
Micro Carbon Residue	ASTM D 4530	mass %	<0.01
Refractive index at 60 °C	ASTM D 1747	-	1.4795
Cetane Index ¹	ASTM D 976	-	61.4
Wax content	UOP 46 obs.	mass %	13.1
UOP K factor	UOP 375	-	11.9
Simulated Distillation	ASTM D 2887		
IBP (0.5%)		°F	639
5% recovered		°F	672
10% recovered		°F	684
15% recovered		°F	695
20% recovered		°F	705

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Attention of : Ms. D. Sundaravadivelu

Analysis Report

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Date received : 05-07-2023
Date of issue : 05-31-2023
Date completed : 05-31-2023
Sample object : Pegasus Tech Svc
Sample number : 14586592
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (650-850°F)

NAME	METHOD	UNIT	RESULT
25% recovered		°F	715
30% recovered		°F	724
35% recovered		°F	735
40% recovered		°F	745
45% recovered		°F	756
50% recovered		°F	766
55% recovered		°F	777
60% recovered		°F	788
65% recovered		°F	799
70% recovered		°F	811
75% recovered		°F	824
80% recovered		°F	837
85% recovered		°F	852
90% recovered		°F	872
95% recovered		°F	902
FBP (99.5%)		°F	970

Remarks:

- 1 Derived from Spiral

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Date of issue	: 05-31-2023	Date received	: 05-07-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-31-2023
Sample type	: Submitted	Sample number	: 14586593
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (850-1050°F)		

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 5236	vol %	11.52
Yield on crude	ASTM D 5236	mass %	12.76
API Gravity & Relative Density	ASTM D 4052		
API Gravity		-	22.0
Relative Density at 60/60°F		-	0.9216
Aniline Point	ASTM D 611	°C	100.40
Elemental analysis	ASTM D 5291		
Carbon		mass %	86.63
Hydrogen		mass %	12.55
Sulphur (S)	ASTM D 4294	mass %	0.668
Acid Number	ASTM D 664		
Acid number		mg KOH/g	0.59
Sample Size		g	2.0362
Inflection or buffer endpoint		-	Inf
Cloud Point	ASTM D 2500	°C	46.6
Kinematic Viscosity at 130 °F	ASTM D 445	mm ² /s	87.68
Kinematic Viscosity at 180 °F	ASTM D 445	mm ² /s	26.90
Nitrogen	ASTM D 5762	WT%	0.1522
Pour Point	ASTM D 97	°C	45
Micro Carbon Residue	ASTM D 4530	mass %	0.90
Refractive index at 60 °C	ASTM D 1747	-	1.4955
Wax content	UOP 46 obs.	mass %	14.9
Metals by ICP	ASTM D 5708		
Iron (Fe) - Method B		mg/kg	< 0.1
Nickel (Ni) - Method B		mg/kg	0.1
Vanadium (V) - Method B		mg/kg	0.1
Metals by ICP	ASTM D 5708		
Copper (Cu) - Method B		mg/kg	< 0.1
UOP K factor	UOP 375	-	12.1
Simulated Distillation	ASTM D 7169		

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Attention of : Ms. D. Sundaravadivelu

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Report Date : 05-31-2023 Sample submitted at : Saybolt LP, Deer Park
Date of issue : 05-31-2023 Date received : 05-07-2023
Sample object : Pegasus Tech Svc Date completed : 05-31-2023
Sample type : Submitted Sample number : 14586593
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (850-1050°F)

NAME	METHOD	UNIT	RESULT
IBP (0.5%)		°F	692
5% recovered		°F	780
10% recovered		°F	813
15% recovered		°F	836
20% recovered		°F	854
25% recovered		°F	869
30% recovered		°F	883
35% recovered		°F	896
40% recovered		°F	908
45% recovered		°F	919
50% recovered		°F	930
55% recovered		°F	940
60% recovered		°F	951
65% recovered		°F	963
70% recovered		°F	975
75% recovered		°F	987
80% recovered		°F	1000
85% recovered		°F	1014
90% recovered		°F	1032
95% recovered		°F	1054
FBP (99.5%)		°F	1122
Boiling Range Residue		mass %	0.5
Recovery		mass %	99.5

Remarks:

- 1 Derived from Spiral

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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PEGASUS TECHNICAL SERVICES, INC.
26 WEST MARTIN LUTHER KING DRIVE
45268, Cincinnati
United States



Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number	: 13072/00015911.1/L/23	Submitted date	: 03-24-2023
Report Date	: 05-31-2023	Sample submitted at	: Saybolt LP, Deer Park
Date of issue	: 05-31-2023	Date received	: 05-07-2023
Sample object	: Pegasus Tech Svc	Date completed	: 05-31-2023
Sample type	: Submitted	Sample number	: 14586594
Sample submitted as	: Petroleum Crude Oil		
Marked	: Bryan Mound Crude Sep 2022 (1050°F plus)		

NAME	METHOD	UNIT	RESULT
Yield on crude	ASTM D 5236	vol %	9.19
Yield on crude	ASTM D 5236	mass %	11.02
API Gravity & Relative Density	ASTM D 4052		
API Gravity ¹		-	10.5
Relative Density at 60/60°F ¹		-	0.9968
Acid Number	ASTM D 664		
Acid number		mg KOH/g	1.1
Sample Size		g	0.6891
Inflection or buffer endpoint		-	Inf
Asphaltenes	ASTM D 6560	mass %	3.8
Micro Carbon Residue	ASTM D 4530	mass %	19.0
UOP K factor	UOP 375	-	12.0
Kinematic Viscosity at 210 °F	ASTM D 445	mm ² /s	1294
Kinematic Viscosity at 180 °F	ASTM D 445	mm ² /s	3423
Metals by ICP	ASTM D 5708		
Iron (Fe) - Method B		mg/kg	3.5
Nickel (Ni) - Method B		mg/kg	38.0
Vanadium (V) - Method B		mg/kg	73.4
Metals by ICP	ASTM D 5708		
Copper (Cu) - Method B		mg/kg	< 0.1
Nitrogen	ASTM D 5762	WT%	0.5137
Sulphur (S)	ASTM D 4294	mass %	1.45
Elemental analysis	ASTM D 5291		
Carbon		mass %	87.13
Hydrogen		mass %	11.03
Simulated Distillation	ASTM D 7169		
IBP (0.5%)		°F	976
5% recovered		°F	1038
10% recovered		°F	1062
15% recovered		°F	1079

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26 WEST MARTIN LUTHER KING DRIVE
45268, Cincinnati
United States



Attention of : Ms. D. Sundaravadivelu

Analysis Report

Report number : 13072/00015911.1/L/23
Submitted date : 03-24-2023
Sample submitted at : Saybolt LP, Deer Park
Report Date : 05-31-2023
Date received : 05-07-2023
Date of issue : 05-31-2023
Date completed : 05-31-2023
Sample object : Pegasus Tech Svc
Sample number : 14586594
Sample type : Submitted
Sample submitted as : Petroleum Crude Oil
Marked : Bryan Mound Crude Sep 2022 (1050°F plus)

NAME	METHOD	UNIT	RESULT
20% recovered		°F	1095
25% recovered		°F	1111
30% recovered		°F	1126
35% recovered		°F	1141
40% recovered		°F	1157
45% recovered		°F	1173
50% recovered		°F	1190
55% recovered		°F	1207
60% recovered		°F	1226
65% recovered		°F	1247
70% recovered		°F	1269
75% recovered		°F	1294
80% recovered		°F	1317
85% recovered		°F	--
90% recovered		°F	--
95% recovered		°F	--
FBP (99.5%)		°F	>1328
Boiling Range Residue		mass %	17.8
Recovery		mass %	82.2

Remarks:

1 By D-70

Signed by: Dan Carlson - Chemist III
Issued by: Saybolt LP
Place and date of issue: Deer Park - 05-31-2023

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Pegasus Technical Services, Inc.
 Bryan Mound Crude Sept. 2022
 15911



FRACTIONAL DISTILLATION SUMMARY

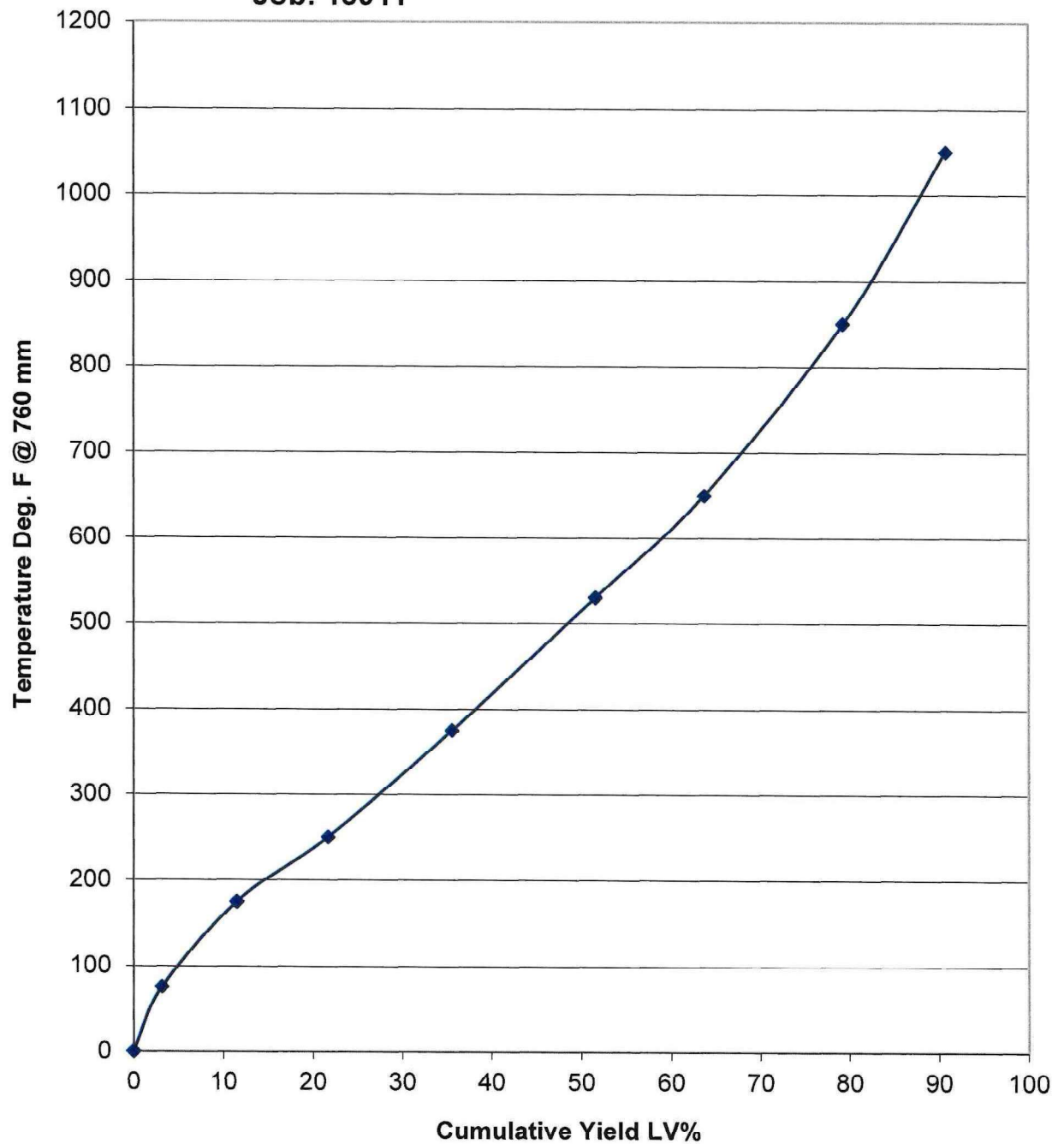
LV %	LV%	Cum.LV%	WT%	Cum WT%	API Gravity	SPG @ 60 F
Original					38.6	0.8320
IBP-75	3.16	3.16	2.23	2.23	111.7	0.5818*
75-175	8.32	11.48	6.76	8.99	79.6	0.6702*
175-250	10.22	21.70	9.14	18.13	60.5	0.7371
250-375	13.87	35.57	13.05	31.18	51.0	0.7755
375-530	15.96	51.53	15.77	46.95	40.6	0.8221
530-650	12.16	63.69	12.50	59.45	34.0	0.8549
650+	36.31	100.00	40.55	100.00	20.8	0.9291
650-850	15.60	79.29	16.77	76.22	26.7	0.8947
850-1050	11.52	90.81	12.76	88.98	22.0	0.9216
1050+	9.19	100.00	11.02	100.00	10.5	0.9968
Total	100.00		100.00			

* By GC

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Pegasus Technical Services
Bryan Mound Sept. 2022
Job: 15911



**Saybolt**

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Saybolt LP**A Core Laboratories Company**

201 Deerwood Glen Dr

Deer Park, TX 77536

281-478-1300

Pegasus**Sample Number 15911-14586585****Sample ID Bryan Mound Crude Sept 2022****IBP-75F**

5/31/2023

ASTM D2163

Page 1 of 2

	WT %	LV %	MOL %
Ethane	0.21	0.34	0.41
Propane	12.89	14.79	17.25
Isobutane	11.39	11.77	11.57
N-Butane	46.25	46.06	46.97
2,2-Dimethylpropane	0.25	0.24	0.20
1-Butyne	0.01	0.01	0.01
3-Methyl-1-butene	0.03	0.03	0.03
Isopentane	20.53	19.11	16.80
1-Pentene	0.02	0.02	0.02
N-Pentane	7.49	6.91	6.13
2,2-Dimethylbutane	0.01	0.01	0.01
Cyclopentane	0.05	0.04	0.04
2,3-Dimethylbutane	0.02	0.02	0.01
2-Methylpentane	0.11	0.10	0.08
3-Methylpentane	0.06	0.05	0.04
N-Hexane	0.19	0.17	0.13
Methylcyclopentane	0.05	0.04	0.04
Benzene	0.01	0.01	0.01
Cyclohexane	0.03	0.02	0.02
2-Methylhexane	0.02	0.02	0.01
3-Methylhexane	0.01	0.01	0.01
N-Heptane	0.02	0.02	0.01
Methylcyclohexane	0.02	0.02	0.01
Toluene	0.32	0.21	0.20
Total	100.00	100.02	100.01
Hexanes	0.44	0.39	0.31
Heptanes	0.14	0.12	0.10
Octanes Plus	0.34	0.23	0.21
Pressure Base, psia	14.696		
Sample Specific Gravity	0.5818		
Sample Molecular Weight	59		
Sample Density, Lbs/Gallon in Air	4.8446		
Sample Density, Lbs/Gallon in Vacuum	4.8506		
Sample Gross Heating Value, BTU/Lb	21098		
Sample Vapor Equivalent, cu.ft./gal	31.2		
C5 Plus Specific Gravity	0.7443		

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Deer Park, TX 77536
281-478-1300

Pegasus

Sample Number 15911-14586585

Sample ID Bryan Mound Crude Sept 2022

IBP-75F

WT %

LV %

MOL %

5/31/2023

ASTM D2163

Page 2 of 2

C5 Plus Molecular Weight	87.7
C5 Plus Density, Lbs/Gallon in Air	6.1978
C5 Plus Density, Lbs/Gallon in Vacuum	6.2054
C5 Plus Gross Heating Value BTU/Lb	19751
C5 Plus Vapor Equivalent, cu.ft./gal	26.85
C6 Plus Specific Gravity	0.8258
C6 Plus Molecular Weight	91.4
C6 Plus Density, Lbs/Gallon in Air	6.8764
C6 Plus Density, Lbs/Gallon in Vacuum	6.8849
C6 Plus Gross Heating Value BTU/Lb	18878
C6 Plus Vapor Equivalent, cu.ft./gal	28.59
C7 Plus Specific Gravity	0.8659
C7 Plus Molecular Weight	92.5
C7 Plus Density, Lbs/Gallon in Air	7.2103
C7 Plus Density, Lbs/Gallon in Vacuum	7.2192
C7 Plus Gross Heating Value BTU/Lb	18354
C7 Plus Vapor Equivalent, cu.ft./gal	29.62



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Pegasus Tech Svc

Sample Number 15911-14586586

Sample ID Bryan Mound Crude Sept 2022

75-175F

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4/18/2023

ASTM D-6733

Page 1 of 2

	WT %	LV %	MOL %
Propane	0.05	0.07	0.09
Isobutane	0.27	0.32	0.37
N-Butane	2.19	2.51	3.00
2,2-Dimethylpropane	0.02	0.02	0.02
1,4-Pentadiene	0.01	0.01	0.01
Isopentane	10.63	11.38	11.75
N-Pentane	22.67	24.06	25.05
2-methyl-1,3-butadiene	0.01	0.01	0.01
3,3-Dimethyl-1-butene	0.01	0.01	0.01
cis-2-Pentene	0.01	0.01	0.01
2,2-Dimethylbutane	0.47	0.48	0.43
Cyclopentane	2.74	2.44	3.11
2,3-Dimethylbutane	1.30	1.31	1.20
2-Methylpentane	11.67	11.87	10.80
3-Methylpentane	6.98	6.98	6.46
N-Hexane	19.13	19.29	17.70
trans-3-Hexene	0.01	0.01	0.01
2,2-Dimethylpentane	0.23	0.23	0.18
Methylcyclopentane	8.24	7.32	7.81
2,4-Dimethylpentane	0.53	0.52	0.42
2,2,3-Trimethylbutane	0.04	0.04	0.03
Benzene	2.42	1.83	2.47
3,3-Dimethylpentane	0.07	0.07	0.06
Cyclohexane	5.08	4.34	4.81
2-Methylhexane	1.16	1.14	0.92
2,3-Dimethylpentane	0.41	0.39	0.33
1,1-Dimethylcyclopentane	0.34	0.30	0.28
3-Methylhexane	0.99	0.96	0.79
cis-1,3-Dimethylcyclopentane	0.43	0.38	0.35
trans-1,3-Dimethylcyclopentane	0.33	0.29	0.27
3-Ethylpentane	0.05	0.05	0.04
trans-1,2-Dimethylcyclopentane	0.58	0.51	0.47
N-Heptane	0.55	0.54	0.44
Methylcyclohexane	0.28	0.24	0.23
2,2-Dimethylhexane	0.01	0.01	0.01
Ethylcyclopentane	0.01	0.01	0.01

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Pegasus Tech Svc**Sample Number 15911-14586586****Sample ID Bryan Mound Crude Sept 2022****75-175F****Saybolt LP****A Core Laboratories Company**

201 Deerwood Glen Dr

Deer Park, TX 77536

281-478-1300

4/18/2023

ASTM D-6733

Page 2 of 2

	WT %	LV %	MOL %
Toluene	0.06	0.05	0.05
Unidentified	0.02	0.00	0.00
Total	100.00	100.00	100.00
Total Paraffins	44.54	46.40	46.19
Total Isoparaffins	34.83	35.77	33.81
Total Olefins	0.05	0.05	0.05
Total Naphthenes	18.03	15.83	17.34
Total Aromatics	2.48	1.88	2.52
Unclassified	0.07	0.07	0.09
Total C4	2.46	2.83	3.37
Total C5	36.10	37.94	39.97
Total C6	55.30	53.43	51.69
Total C7	6.06	5.72	4.87
Total C8	0.01	0.01	0.01
C4 Paraffin	2.19	2.51	3.00
C5 Paraffin	22.67	24.06	25.05
C6 Paraffin	19.13	19.29	17.70
C7 Paraffin	0.55	0.54	0.44
C4 Isoparaffin	0.27	0.32	0.37
C5 Isoparaffin	10.65	11.40	11.77
C6 Isoparaffin	20.42	20.64	18.89
C7 Isoparaffin	3.48	3.40	2.77
C8 Isoparaffin	0.01	0.01	0.01
C5 Olefin	0.04	0.04	0.04
C6 Olefin	0.01	0.01	0.01
C5 Naphthene	2.74	2.44	3.11
C6 Naphthene	13.32	11.66	12.62
C7 Naphthene	1.97	1.73	1.61
C6 Aromatic	2.42	1.83	2.47
C7 Aromatic	0.06	0.05	0.05
Mol WT of Sample, gm/mol	79.72		
Density of Sample, gm/cc	0.6695		



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Pegasus Tech Svc

Sample Number 15911-14586587

Sample ID Bryan Mound Crude Sept 2022

175-250F

Saybolt LP

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Deer Park, TX 77536

281-478-1300

5/8/2023

ASTM D-6733

Page 1 of 4

	WT %	LV %	MOL %
N-Butane	0.02	0.03	0.03
Isopentane	0.03	0.04	0.04
N-Pentane	0.12	0.14	0.17
2,2-Dimethylbutane	0.01	0.01	0.01
Cyclopentane	0.11	0.11	0.16
2,3-Dimethylbutane	0.08	0.09	0.09
2-Methylpentane	0.73	0.82	0.85
3-Methylpentane	0.64	0.71	0.75
N-Hexane	2.86	3.18	3.34
2,2-Dimethylpentane	0.13	0.14	0.13
Methylcyclopentane	2.36	2.31	2.82
2,4-Dimethylpentane	0.34	0.37	0.34
2,2,3-Trimethylbutane	0.03	0.03	0.03
Benzene	0.75	0.63	0.97
3,3-Dimethylpentane	0.13	0.14	0.13
Cyclohexane	4.43	4.17	5.29
2-Methylhexane	4.05	4.37	4.07
2,3-Dimethylpentane	1.37	1.44	1.38
1,1-Dimethylcyclopentane	0.91	0.88	0.93
3-Methylhexane	5.04	5.37	5.06
cis-1,3-Dimethylcyclopentane	2.01	1.98	2.06
trans-1,3-Dimethylcyclopentane	1.91	1.87	1.96
3-Ethylpentane	0.38	0.40	0.38
trans-1,2-Dimethylcyclopentane	3.50	3.41	3.59
2,2,4-Trimethylpentane	0.03	0.03	0.03
N-Heptane	13.80	14.80	13.85
Methylcyclohexane	15.01	14.30	15.38
2,2-Dimethylhexane	1.30	1.37	1.14
Ethylcyclopentane	1.12	1.07	1.15
2,5-Dimethylhexane	0.61	0.64	0.54
2,4-Dimethylhexane	0.80	0.84	0.70
trans,cis-1,2,4-Trimethylcyclopentane	1.26	1.24	1.13
3,3-Dimethylhexane	0.18	0.19	0.16
trans,cis-1,2,3-Trimethylcyclopentane	1.35	1.31	1.21
C8 Olefin	0.39	0.40	0.35
2,3,4-Trimethylpentane	0.15	0.15	0.13

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Pegasus Tech Svc

Sample Number 15911-14586587

**Sample ID Bryan Mound Crude Sept 2022
175-250F**

Saybolt LP

A Core Laboratories Company

201 Deerwood Glen Dr

Deer Park, TX 77536

281-478-1300

5/8/2023

ASTM D-6733

Page 2 of 4

	WT %	LV %	MOL %
Toluene	6.32	5.35	6.90
2,3-Dimethylhexane	0.57	0.59	0.50
2-Methyl-3-ethylpentane	0.22	0.22	0.19
2-Ethyl-1-hexene	4.20	4.13	3.76
4-Methylheptane	1.39	1.45	1.22
3,4-Dimethylhexane	0.15	0.15	0.13
cis,trans-1,2,4-Trimethylcyclopentane	0.15	0.14	0.13
3-Methylheptane	3.31	3.44	2.91
cis-1,3-Dimethylcyclohexane	1.90	1.82	1.70
3-Ethylhexane	0.51	0.52	0.45
trans-1,4-Dimethylcyclohexane	0.95	0.91	0.85
1,1-Dimethylcyclohexane	0.38	0.36	0.34
trans-1-Ethyl-3-methylcyclopentane	0.34	0.33	0.30
cis-1-Ethyl-3-methylcyclopentane	0.35	0.33	0.31
trans-1-Ethyl-2-methylcyclopentane	0.66	0.63	0.59
1-Ethyl-1-methylcyclopentane	0.09	0.08	0.08
trans-1,2-Dimethylcyclohexane	1.04	0.98	0.93
cis,cis-1,2,3-Trimethylcyclopentane	0.02	0.02	0.02
trans-3-Octene	0.60	0.61	0.54
cis-1,4-Dimethylcyclohexane	0.05	0.04	0.04
N-Octane	5.47	5.71	4.81
2,2,4-Trimethylhexane	0.04	0.04	0.03
Isopropylcyclopentane	0.04	0.04	0.04
2,3,5-Trimethylhexane	0.03	0.03	0.02
2,2-Dimethylheptane	0.04	0.04	0.03
cis-1,2-Dimethylcyclohexane	0.10	0.09	0.09
2,4-Dimethylheptane	0.14	0.14	0.11
4,4-Dimethylheptane	0.01	0.01	0.01
Ethylcyclohexane	0.85	0.79	0.76
2-Methyl-4-ethylhexane	0.01	0.01	0.01
2,6-Dimethylheptane	0.25	0.26	0.20
1,1,3-Trimethylcyclohexane	0.18	0.17	0.14
C9 Naphthene	0.05	0.05	0.04
2,5-Dimethylheptane	0.11	0.11	0.09
3,5-Dimethylheptane	0.04	0.04	0.03
2-Methyl-3-ethylhexane	0.01	0.01	0.01

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Saybolt

A CORE LABORATORIES COMPANY

Pegasus Tech Svc

Sample Number 15911-14586587

Sample ID Bryan Mound Crude Sept 2022

175-250F

Saybolt LP

A Core Laboratories Company

201 Deerwood Glen Dr

Deer Park, TX 77536

281-478-1300

5/8/2023

ASTM D-6733

Page 3 of 4

	WT %	LV %	MOL %
2,3,3-Trimethylhexane	0.36	0.37	0.28
Ethylbenzene	0.03	0.03	0.03
2,3,4-Trimethylhexane	0.04	0.04	0.03
trans,trans-1,2,4-Trimethylcyclohexane	0.01	0.01	0.01
Meta-Xylene	0.51	0.43	0.48
Para-Xylene	0.17	0.14	0.16
2,3-Dimethylheptane	0.06	0.06	0.05
3,4-Dimethylheptane D/L	0.04	0.04	0.03
4-Ethylheptane	0.01	0.01	0.01
4-Methyloctane	0.03	0.03	0.02
2-Methyloctane	0.04	0.04	0.03
3-Methyloctane	0.01	0.01	0.01
Styrene	0.03	0.03	0.03
Ortho-Xylene	0.10	0.08	0.09
cis-1-Ethyl-3-methylcyclohexane	0.01	0.01	0.01
N-Nonane	0.02	0.02	0.02
Unidentified	0.03	0.03	0.05
Total	100.00	100.00	100.00
Total Paraffins	22.29	23.88	22.22
Total Isoparaffins	23.45	24.81	22.36
Total Olefins	5.22	5.17	4.68
Total Naphthenes	41.14	39.45	42.06
Total Aromatics	7.88	6.66	8.63
Unclassified	0.03	0.03	0.05
Total C4	0.02	0.03	0.03
Total C5	0.26	0.29	0.37
Total C6	11.86	11.92	14.12
Total C7	56.05	55.92	57.34
Total C8	30.28	30.30	26.90
Total C9	1.50	1.51	1.19
C4 Paraffin	0.02	0.03	0.03
C5 Paraffin	0.12	0.14	0.17
C6 Paraffin	2.86	3.18	3.34
C7 Paraffin	13.80	14.80	13.85
C8 Paraffin	5.47	5.71	4.81
C9 Paraffin	0.02	0.02	0.02

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Saybolt

A CORE LABORATORIES COMPANY

Pegasus Tech Svc

Sample Number 15911-14586587

Sample ID Bryan Mound Crude Sept 2022

175-250F

Saybolt LP

A Core Laboratories Company

201 Deerwood Glen Dr

Deer Park, TX 77536

281-478-1300

5/8/2023

ASTM D-6733

Page 4 of 4

	WT %	LV %	MOL %
C5 Isoparaffin	0.03	0.04	0.04
C6 Isoparaffin	1.46	1.63	1.70
C7 Isoparaffin	11.47	12.26	11.52
C8 Isoparaffin	9.26	9.63	8.13
C9 Isoparaffin	1.23	1.25	0.97
C8 Olefin	5.22	5.17	4.68
C5 Naphthene	0.11	0.11	0.16
C6 Naphthene	6.79	6.48	8.11
C7 Naphthene	24.46	23.51	25.07
C8 Naphthene	9.53	9.11	8.52
C9 Naphthene	0.25	0.24	0.20
C6 Aromatic	0.75	0.63	0.97
C7 Aromatic	6.32	5.35	6.90
C8 Aromatic	0.81	0.68	0.76
Mol WT of Sample, gm/mol	100.59		
Density of Sample, gm/cc	0.7379		



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Pegasus Tech Svc

Sample Number 15911-14586588

**Sample ID Bryan Mound Crude Sept 2022
250-375F**

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ASTM D-6733

Page 1 of 7

	WT %	LV %	MOL %
N-Hexane	0.01	0.01	0.01
Methylcyclopentane	0.01	0.01	0.02
5-Methyl-1-hexene	0.04	0.04	0.05
2-Methylhexane	0.03	0.03	0.04
2,3-Dimethylpentane	0.01	0.01	0.01
1,1-Dimethylcyclopentane	0.01	0.01	0.01
3-Methylhexane	0.05	0.06	0.06
5-Methyl-cis-2-hexene	0.03	0.03	0.04
trans-1,3-Dimethylcyclopentane	0.03	0.03	0.04
trans-1,2-Dimethylcyclopentane	0.05	0.05	0.07
N-Heptane	0.25	0.28	0.32
2,3-Dimethyl-2-pentene	0.80	0.82	1.04
2,2-Dimethylhexane	0.08	0.09	0.09
Ethylcyclopentane	0.07	0.07	0.09
2,5-Dimethylhexane	0.04	0.04	0.04
2,4-Dimethylhexane	0.06	0.07	0.07
trans,cis-1,2,4-Trimethylcyclopentane	0.14	0.14	0.16
3,3-Dimethylhexane	0.02	0.02	0.02
trans,cis-1,2,3-Trimethylcyclopentane	0.17	0.17	0.19
3-Methyl-1-heptene	0.02	0.02	0.02
C8 Olefin	0.21	0.22	0.24
Toluene	0.56	0.50	0.78
2,3-Dimethylhexane	0.10	0.11	0.11
2-Methyl-3-ethylpentane	0.04	0.04	0.04
2-Methylheptane	0.97	1.07	1.09
4-Methylheptane	0.34	0.37	0.38
3,4-Dimethylhexane	0.04	0.04	0.04
cis,trans-1,2,4-Trimethylcyclopentane	0.04	0.04	0.05
3-Methylheptane	0.99	1.08	1.11
cis-1,3-Dimethylcyclohexane	0.92	0.92	1.05
3-Ethylhexane	0.17	0.18	0.19
trans-1,4-Dimethylcyclohexane	0.46	0.46	0.52
1,1-Dimethylcyclohexane	0.18	0.18	0.21
trans-1-Ethyl-3-methylcyclopentane	0.16	0.16	0.18
cis-1-Ethyl-3-methylcyclopentane	0.17	0.17	0.19
trans-1-Ethyl-2-methylcyclopentane	0.33	0.33	0.38

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Pegasus Tech Svc**Sample Number 15911-14586588****Sample ID Bryan Mound Crude Sept 2022****250-375F****Saybolt LP****A Core Laboratories Company**

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ASTM D-6733

Page 2 of 7

	WT %	LV %	MOL %
1-Ethyl-1-methylcyclopentane	0.05	0.05	0.06
trans-1,2-Dimethylcyclohexane	0.85	0.84	0.97
cis,cis-1,2,3-Trimethylcyclopentane	0.01	0.01	0.01
trans-3-Octene	0.54	0.58	0.62
cis-1,4-Dimethylcyclohexane	0.03	0.02	0.03
N-Octane	4.45	4.86	4.98
2,2,4-Trimethylhexane	0.08	0.09	0.08
2,3,5-Trimethylhexane	0.07	0.07	0.07
cis-1-Ethyl-2-methylcyclopentane	0.07	0.07	0.08
2,2-Dimethylheptane	0.11	0.12	0.11
cis-1,2-Dimethylcyclohexane	0.23	0.22	0.26
2,4-Dimethylheptane	0.49	0.53	0.49
4,4-Dimethylheptane	0.06	0.06	0.06
Nonenes	1.48	1.59	1.69
Ethylcyclohexane	2.62	2.55	2.99
2-Methyl-4-ethylhexane	0.04	0.04	0.04
1,1,4-Trimethylcyclohexane	1.20	1.18	1.22
1,1,3-Trimethylcyclohexane	1.47	1.45	1.49
C9 Naphthene	0.87	0.86	0.88
2,5-Dimethylheptane	0.67	0.72	0.67
3,5-Dimethylheptane	0.30	0.32	0.30
2-Methyl-3-ethylhexane	0.13	0.14	0.13
2,3,3,Trimethylhexane	1.07	1.15	1.07
Ethylbenzene	0.35	0.31	0.42
2,3,4-Trimethylhexane	0.88	0.91	0.88
trans,trans-1,2,4-Trimethylcyclohexane	0.07	0.07	0.07
Meta-Xylene	3.02	2.68	3.64
Para-Xylene	0.84	0.75	1.01
2,3-Dimethylheptane	1.09	1.15	1.09
3,4-Dimethylheptane D/L	0.41	0.43	0.41
3,4-Dimethylheptane L/D	0.11	0.12	0.11
4-Ethylheptane	0.06	0.06	0.06
4-Methyloctane	1.15	1.22	1.15
2-Methyloctane	1.47	1.58	1.47
cis,cis-1,2,3-Trimethylcyclohexane	0.11	0.11	0.11
3-Ethylheptane	0.31	0.33	0.31

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Pegasus Tech Svc

Sample Number 15911-14586588

Sample ID Bryan Mound Crude Sept 2022

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ASTM D-6733

Page 3 of 7

	WT %	LV %	MOL %
3-Methyloctane	0.34	0.36	0.34
trans,cis-1,2,4-Trimethylcyclohexane	1.74	1.71	1.76
Ortho-Xylene	1.82	1.59	2.19
cis,trans-1,2,4-Trimethylcyclohexane	0.10	0.10	0.10
2,4,6-Trimethylheptane	0.04	0.04	0.04
trans-1-Methyl-2-propylcyclopentane	0.02	0.02	0.02
2,2,6-Trimethylheptane	0.98	0.98	0.88
cis-1-Ethyl-3-methylcyclohexane	0.93	0.89	0.94
trans-1-Ethyl-4-methylcyclohexane	0.73	0.70	0.74
1-Nonene	0.04	0.04	0.04
Isobutylcyclopentane	0.09	0.09	0.09
trans,trans-1,2,3-Trimethylcyclohexane	0.16	0.15	0.16
N-Nonane	8.17	8.73	8.15
1-Ethyl-1-methylcyclohexane	0.16	0.16	0.16
trans-1-Ethyl-3-methylcyclohexane	0.12	0.12	0.12
Isopropylbenzene	0.35	0.31	0.37
Bicyclononane	0.84	0.83	0.85
Isopropylcyclohexane	0.49	0.47	0.50
2,4-Dimethyloctane	0.23	0.25	0.21
2,5-Dimethyloctane	0.21	0.22	0.19
cis-1-Ethyl-4-methylcyclohexane	0.41	0.40	0.42
Sec-butylcyclopentane	0.07	0.07	0.07
tert-Butylcyclopentane	0.18	0.17	0.18
3,5-Dimethyloctane	1.62	1.70	1.46
N-propylcyclohexane	0.39	0.38	0.40
2,7-Dimethyloctane	0.42	0.45	0.38
2,6-Dimethyloctane	1.64	1.73	1.47
3,3-Dimethyloctane	0.24	0.25	0.22
n-Propylbenzene	0.91	0.81	0.97
3,6-Dimethyloctane	0.36	0.38	0.32
4,5-Dimethyloctane	0.95	0.99	0.85
3-methyl-5-ethylheptane	0.24	0.25	0.22
1-Methyl-3-ethylbenzene	1.20	1.06	1.28
1-Methyl-4-ethylbenzene	0.57	0.51	0.61
1,3,5-Trimethylbenzene	0.86	0.76	0.92
4-Ethyloctane	0.39	0.41	0.35

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Sample Number 15911-14586588

Sample ID Bryan Mound Crude Sept 2022

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ASTM D-6733

Page 4 of 7

	WT %	LV %	MOL %
2,3-Dimethyloctane	0.19	0.20	0.17
5-Methylnonane	0.08	0.08	0.07
4-Methylnonane	0.37	0.39	0.33
1-Methyl-2-ethylbenzene	1.65	1.44	1.76
2-Methylnonane	1.18	1.25	1.06
3-Ethyloctane	0.26	0.27	0.23
1,2,3,5-Tetramethylcyclohexane	0.32	0.31	0.29
3-Methylnonane	1.14	1.19	1.02
1,4 Dimethyl-2-ethylcyclohexane	2.18	2.13	1.99
trans-1-Ethyl-2-methylcyclohexane	0.60	0.59	0.61
cis-1-Methyl-3-propylcyclohexane	0.89	0.87	0.81
cis-1,3-Diethylcyclohexane	0.16	0.16	0.15
trans-1,4-Diethylcyclohexane	0.17	0.17	0.16
trans-1-Methyl-3-propylcyclohexane	0.16	0.16	0.15
1-Ethyl-2,3-dimethylcyclohexane	0.20	0.20	0.18
Decenes	1.66	1.60	1.51
Isobutylbenzene	0.37	0.33	0.35
sec-Butylbenzene	0.44	0.39	0.42
C10 Naphthenes	0.72	0.70	0.66
C10 Paraffins	0.45	0.46	0.37
N-Decane	5.90	6.20	5.30
trans-1,3-Diethylcyclohexane	0.07	0.07	0.06
1,2,3-Trimethylbenzene	0.87	0.75	0.93
1-Methyl-3-isopropylbenzene	0.40	0.36	0.38
1-Methyl-4-isopropylbenzene	0.28	0.25	0.27
cis-1,4-Diethylcyclohexane	0.16	0.16	0.15
Indan (2,3-Dihydroindene)	0.19	0.15	0.21
Sec-butylcyclohexane	0.21	0.21	0.19
1-Methyl-2-isopropylbenzene	0.56	0.49	0.53
2,6-Dimethylnonane	1.50	1.65	1.23
Butylcyclohexane	1.04	1.00	0.95
1-Methyl-3-n-propylbenzene	0.55	0.49	0.52
1-Methyl-4-n-propylbenzene	0.41	0.37	0.39
1,4-Diethylbenzene	0.36	0.32	0.34
N-Butylbenzene	0.32	0.29	0.30
1,3-Dimethyl-5-ethylbenzene	0.18	0.16	0.17

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Pegasus Tech Svc

Sample Number 15911-14586588

**Sample ID Bryan Mound Crude Sept 2022
250-375F**

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201 Deerwood Glen Dr

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281-478-1300

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ASTM D-6733

Page 5 of 7

	WT %	LV %	MOL %
1,2-Diethylbenzene	0.08	0.07	0.08
trans-Decalin	0.41	0.35	0.38
1-Methyl-2-n-propylbenzene	0.56	0.49	0.53
5-Methyldecane	0.44	0.45	0.36
4-Methyldecane	0.48	0.49	0.39
1,4-Dimethyl-2-ethylbenzene	0.25	0.22	0.24
2-Methyldecane	0.84	0.86	0.69
3-Methyldecane	0.15	0.15	0.12
1,2-Dimethyl-4-ethylbenzene	0.76	0.67	0.72
1,3-Dimethyl-2-ethylbenzene	0.06	0.05	0.06
1,2-Dimethyl-3-Ethylbenzene	0.32	0.28	0.30
C11 Aromatics	0.49	0.43	0.42
C11 Naphthenes	1.22	1.18	0.93
C11 Paraffins	0.30	0.31	0.23
C11 Olefins	0.84	0.75	0.81
N-Undecane	2.60	2.70	2.13
1,2,4,5-Tetramethylbenzene	0.18	0.16	0.17
1,2,3,5-Tetramethylbenzene	0.18	0.16	0.17
C12 Unidentified	0.02	0.02	0.02
5-Methylindan	0.06	0.05	0.06
4-Methylindan	0.13	0.11	0.13
1,2,3,4-Tetramethylbenzene	0.18	0.15	0.17
Pentylbenzene	0.10	0.09	0.09
5-Methylundecane	0.09	0.09	0.07
4-Methylundecane	0.05	0.05	0.04
2-Methylundecane	0.05	0.05	0.04
3-Methylundecane	0.02	0.02	0.02
Tetralin	0.09	0.07	0.09
Naphthalene	0.02	0.02	0.02
1,2-Dimethylindan	0.01	0.01	0.01
2-Ethylindan	0.02	0.02	0.02
1,3,5-Triethylbenzene	0.01	0.01	0.01
N-Dodecane	0.08	0.08	0.06
1,3-Dimethylindan	0.01	0.01	0.01
Unidentified	0.35	0.38	0.25
Total	100.00	100.00	100.00

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Page 6 of 7

	WT %	LV %	MOL %
Total Paraffins	21.46	22.86	20.95
Total Isoparaffins	27.05	28.58	25.49
Total Olefins	5.66	5.69	6.06
Total Naphthenes	24.90	24.33	25.17
Total Aromatics	20.76	18.29	22.27
Unclassified	0.18	0.25	0.06
Total C6	0.02	0.02	0.03
Total C7	1.93	1.93	2.55
Total C8	20.60	20.54	23.71
Total C9	35.20	35.39	35.97
Total C10	32.77	32.47	30.00
Total C11	9.00	9.10	7.44
Total C12	0.30	0.30	0.24
C6 Paraffin	0.01	0.01	0.01
C7 Paraffin	0.25	0.28	0.32
C8 Paraffin	4.45	4.86	4.98
C9 Paraffin	8.17	8.73	8.15
C10 Paraffin	5.90	6.20	5.30
C11 Paraffin	2.60	2.70	2.13
C12 Paraffin	0.08	0.08	0.06
C7 Isoparaffin	0.09	0.10	0.11
C8 Isoparaffin	2.93	3.20	3.26
C9 Isoparaffin	8.76	9.31	8.76
C10 Isoparaffin	11.35	11.85	10.17
C11 Isoparaffin	3.71	3.91	3.02
C12 Isoparaffin	0.21	0.21	0.17
C7 Olefin	0.87	0.89	1.13
C8 Olefin	0.77	0.82	0.88
C9 Olefin	1.52	1.63	1.73
C10 Olefin	1.66	1.60	1.51
C11 Olefin	0.84	0.75	0.81
C6 Naphthene	0.01	0.01	0.02
C7 Naphthene	0.16	0.16	0.21
C8 Naphthene	6.43	6.33	7.33
C9 Naphthene	10.15	9.93	10.28
C10 Naphthene	6.93	6.72	6.40

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ASTM D-6733

Page 7 of 7

	WT %	LV %	MOL %
C11 Naphthene	1.22	1.18	0.93
C7 Aromatic	0.56	0.50	0.78
C8 Aromatic	6.03	5.33	7.26
C9 Aromatic	6.60	5.79	7.05
C10 Aromatic	6.93	6.10	6.62
C11 Aromatic	0.63	0.56	0.55
C12 Aromatic	0.01	0.01	0.01
Mol WT of Sample, gm/mol	127.89		
Density of Sample, gm/cc	0.7721		



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