Exposure-Related Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) on Juvenile Unionid Mussels

By Kerry L. Weber, James A. Luoma, Denise A. Mayer, Doug B. Aloisi, and Nathan L. Eckert

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Conversion Factors

International System of Units to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
micrometer (µm)	3.937×10^{-5}	inch (in.)
millimeter (mm)	0.03937	inch (in.)
	Volume	
liter (L)	2.113	pint (pt)
liter (L)	1.057	quart (qt)
liter (L)	0.2642	gallon (gal)
milliliter (mL)	0.03382	ounce, fluid (fl. oz)
	Flow rate	
milliliter per minute (mL/min)	0.0002642	gallon per minute (gal/min)
	Mass	
milligram (mg)	3.527×10^{-5}	ounce, avoirdupois (oz)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as °F = (1.8 × °C) + 32.

Conductivity is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given in milligrams per liter (mg/L).

Abbreviations

AI	active ingredient of *Pseudomonas fluorescens*
Alk.	alkalinity as $CaCO_3$
$CaCO_3$	calcium carbonate
CL145A	strain of *Pseudomonas fluorescens*
Cond.	conductivity
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
FDP	freeze-dried powder
Hard.	hardness as $CaCO_3$
HD	heat-deactivated *Pseudomonas fluorescens*
L × W × H	length by width by height
NH_3	un-ionized ammonia
NH_3-N/L	un-ionized ammonia nitrogen per liter
Pf-CL 145A	*Pseudomonas fluorescens* strain CL 145A
SDP	spray-dried powder
TAN	total ammonia nitrogen
Temp	temperature (in °C)
UMESC	Upper Midwest Environmental Sciences Center
USGS	U.S. Geological Survey

Exposure-Related Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) on Juvenile Unionid Mussels

By Kerry L. Weber,[1] James A. Luoma,[1] Denise A. Mayer,[2] Doug B. Aloisi,[3] and Nathan L. Eckert[3]

Abstract

The exposure-related effects of a commercially prepared spray-dried powder (SDP) or freeze-dried powder (FDP) formulation of *Pseudomonas fluorescens* (strain CL145A) on the survival of seven species of newly metamorphosed (< 72 hours old) freshwater unionid mussels was evaluated. Forty unionid mussels of each species were randomly distributed to test chambers and each species independently exposed for 24 hours to a static dose of either SDP (four species: *Lampsilis cardium*, *Lampsilis siliquoidea*, *Lampsilis higginsii*, and *Ligumia recta*) or FDP (three species: *Obovaria olivaria*, *Actinonaias ligamentina*, and *Megalonaias nervosa*).

Each test chamber was assigned to one of six treatment groups (*n* = four chambers per group) by using a randomized block design. The six treatment groups included (1) an untreated control group, (2) groups that received applications with nominal target active ingredient (AI) concentrations of 50, 100, 200, and 300 milligrams per liter (mg/L), and (3) a group that received an application with a nominal target AI concentration of 300 mg/L of heat-deactivated test article (300 HD). After a 24-hour exposure period, water inflow to the test chambers was restored, and the unionid mussels were maintained for an additional 7 days before they were assessed for survival.

Mean survival of four unionid mussels species exposed to SDP varied among species and treatment groups when compared to the untreated control groups. The results indicate that exposure to SDP-formulated *P. fluorescens* up to the maximum label concentration (100 mg/L AI) and up to three times the maximum label exposure duration (8 hours) is not likely to affect the survival of *L. siliquoidea* and *L. higginsii*. Low mean survival in the *L. recta* control group (25.0 percent) indicates that results for *L. recta* should be interpreted with caution. Mean survival of the *L. cardium* was significantly lower in all treated groups (14.4 to 40.6 percent) compared to the control group (68.8 percent). These results indicate that further investigation on the impact of SDP-formulated *P. fluorescens* on *L. recta* and *L. cardium* is warranted.

Mean survival of three unionid mussels species exposed to FDP was not significantly different in the 50-, 100-, and 200-mg/L AI treatment groups and the 300 mg/L heat-deactivated treatment groups when compared to the control groups. Mean survival of *O. olivaria* and *M. nervosa* was significantly lower in the 300-mg/L AI treated groups (38.1 and 48.1 percent, respectively) compared to the control groups (71.9 and 88.1 percent, respectively). The results indicate that exposure to FDP-formulated *P. fluorescens* up to the maximum label concentration (100 mg/L AI) and up to three times the

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maximum label exposure duration (8 hours) is not likely to affect the survival of *O. olivaria*, *A. ligamentina*, and *M. nervosa*.

Introduction

Freshwater unionid mussel populations of North America were historically considered the most diverse in the world, but diversity has rapidly declined and continues to decrease in response to a variety of anthropogenic influences such as habitat degradation and alteration, pollution, and overharvest (Williams and others, 1993; Strayer and others, 2004). Out of the 250 species of unionid mussels in North America listed on the International Union for Conservation Red List, 39 species have a stable or increasing population, whereas 72 percent are currently threatened, imperiled, or candidates for listing, and 12 percent are extinct (http://www.iucnredlist.org/, accessed January 7, 2015). According to Ricciardi and Rasmussen (1999), an estimated 127 unionid mussel species will be lost within the next 100 years; however, this conservative 6.4 percent decadal extinction rate does not factor in extirpations related to invasions by dreissenid mussels (zebra, *Dreissena polymorpha,* and quagga, *D. rostriformis bugensis*).

Because of their high reproductive capacity and their planktonic lifestage, dreissenid mussels can quickly disperse and inundate aquatic environments (Mackie, 1991; Birnbaum, 2011; Benson and others 2015). Since their introduction and establishment in the Great Lakes in the 1980s, zebra mussels have been documented in 680 lakes within 27 states (U.S. Geological Survey, 2014). Zebra mussels adhering to unionid mussels have been documented to contain > 10,000 individuals weighing from two to five times as much as the unionid mussel (Hebert and others, 1991; Mackie, 1991). For example, in a power plant canal in Lake Erie, Schloesser and Kovalak (1991) observed in excess of 10,000 zebra mussels colonized on unionid mussels and a mean colonization estimate of 6,800 zebra mussels per unionid.

Zebra mussel colonization may interfere with unionid mussel locomotion, feeding, reproduction, and respiration (Mackie, 1991; Schloesser and Kovalak, 1991), and it has been linked to the starvation of unionids through competition for food resources (Baker and Hornbach, 1997; Strayer and Malcom, 2007). Heavily colonized unionid mussels may lack the energy reserves required to survive winter, and their ability to burrow into the sediment to avoid environmental stressors may be impeded (Nalepa, 1994; Schloesser and Nalepa, 1994). Unionid mussel extirpations and population declines have been linked to zebra mussels (Burlakova and others, 2000); prediction models estimate that colonization by as few as 100 zebra mussels can result in unionid mussel mortality (Ricciardi and others, 1995).

Federal and state management agencies have implemented recovery and propagation programs for threatened and endangered unionid species that coincide with legislation and programs for control and removal of introduced and invasive species such as zebra mussels (Neves, 2004; Nalepa and Schloesser, 2014). There is a lack of safe and effective tools to control dreissenid mussels in open-water environments, and the impacts of zebra mussels on unionid mussels have made it clear that such tools are of utmost importance. One potential option for limited open-water control of dreissenid mussels is a commercially prepared formulation of a specific strain (CL145A) of the common soil bacterium *Pseudomonas fluorescens* (Molloy, Mayer, Gaylo, Morse, and others, 2013). *Pseudomonas fluorescens* strain CL145A was discovered to be selectively toxic to dreissenid mussels by scientists at the New York State Museum Field Research Laboratory (Cambridge, New York). Ingestion of *Pseudomonas fluorescens* strain CL145A was found to cause cell necrosis in the epithelium lining of the dreissenid mussels' digestive tract, which ultimately induces mortality (Molloy, Mayer, Gaylo, Burlakova, and others, 2013).

Newly metamorphosed unionid mussels are ecologically and physiologically different from adult unionid mussels (ASTM International, 2013). Therefore, it is critical to know the potential exposure-related effects of formulated *P. fluorescens* on the newly metamorphosed life stage of unionid mussels before *P. fluorescens* is applied to open-water environments containing unionid mussels. Recommendations in the standard guide for laboratory toxicity tests with freshwater unionid mussels include initiating tests on juvenile unionid mussels within 5 days of excysting from host fish and completing tests within 14 days because of high mortality rates observed 4 to 6 weeks after transformation (ASTM International, 2013). Consistent with these recommendations, the objective of this study was to determine the survival of newly metamorphosed unionid mussels after exposure to spray-dried powder (SDP) or freeze-dried powder (FDP) formulated *P. fluorescens* in a 24-hour exposure.

Materials and Methods

The protocol for this study entitled "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile unionid mussels from seven different unionid species" is presented in appendix 1 (item 1). All methods and materials follow the written protocol except those instances that were identified in notes to file (appendix 1, items 2–3), study protocol amendments (appendix 1, items 4–12), and study deviations (appendix 2, items 1–12).

Experimental Design

Laboratory trials were completed at the U.S. Geological Survey's Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, to assess the survival of newly metamorphosed unionid mussels following exposure to commercially prepared formulations of *P. fluorescens*, strain CL145A (SDP or FDP formulation). Seven species (table 1) endemic to the Great Lakes and (or) Mississippi River Basins were evaluated in the study trials. The four species of newly metamorphosed unionid mussels exposed to SDP were *Lampsilis cardium*, *Lampsilis siliquoidea*, *Lampsilis higginsii*, and *Ligumia recta*; the three species of newly metamorphosed unionid mussels exposed to FDP were *Obovaria olivaria*, *Actinonaias ligamentina*, and *Megalonaias nervosa*. Individual juvenile unionid mussels (< 72 hours old) were assessed for viability and randomly assigned to a test chamber in equal proportions (n = 960 per species; 40 per test chamber; appendix 3, items 7–12).

Treatments were assigned to test chambers by using a randomized block design (appendix 3, items 13–18). Six treatment groups (n = 4 per treatment group) were tested and included (1) an untreated control, (2) nominal target treatment concentrations of 50, 100, 200, and 300 milligrams per liter (mg/L) based on active ingredient (AI), and (3) a nominal target treatment concentration of 300 mg/L AI of heat-deactivated SDP or FDP test article (300 HD). The experimental unit for the trial was the individual test chamber.

At the conclusion of the 24-hour exposure period, the SDP- or FDP-treated water was drained from each test chamber and each test chamber flushed with fresh water prior to resuming the chamber water inflow. The unionid mussels were maintained in the test chambers for an additional 7-day postexposure holding period. At the conclusion of the 7-day postexposure holding period, each unionid mussel was individually assessed for survival as indicated by active foot movement.

Table 1. Identification and characteristics of test animals and test articles formulations.

Scientific name	Common name	Abbreviation	Test article			Exposure date
			Type	Lot number	Biological activity (percent)	
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	98.7 ± 2.3	July, 12 2011
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	98.7 ± 2.3	July 14, 2011
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	96.0 ± 6.9	December 13, 2011
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	85.3 ± 11.5	January 27, 2012
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	70.7 ± 2.3	April 17, 2012
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	76.0 ± 8.0	May 16, 2012
Lampsilis higginsii	Higgins' eye	HGE	SDP	TR4669-4-(5)	76.0 ± 6.9	May 26, 2012

Test Article

The test articles, produced by Marrone Bio Innovations, Inc. (Davis, California), were a commercially prepared SDP formulation and FDP formulation of *P. fluorescens* (strain CL145A) containing 50 and 100 percent AI (weight-to-weight ratio *P. fluorescens,* strain CL145A), respectively. Multiple formulations of test article were used during the course of this study because of the withdrawal of support for the FDP formulation by Marrone Bio Innovations, Inc. Data derived with the FDP formulation are included within the report; however, the formulation is not currently being manufactured.

Test article concentrations are reported as nominal target concentrations of active ingredient. Test article use was documented in test chemical logbooks (appendix 4, items 24–28). Verification of biological activity was determined for each lot of test article after use in the study by the New York State Museum Field Research Laboratory (Cambridge, New York) using their standard dreissenid mussel bioassay (appendix 4, items 29–34). The bioassays verified retention of biological activity for each lot of test article with mean mortality rates of 70.7 to 98.7 percent for treated zebra mussels compared to 0.0 to 4.0 percent in the untreated groups (table 1; appendix 4, items 29–34).

Test System

Three independent test systems were constructed, and each system consisted of a series of 24 glass test chambers (17.8 × 5.1 × 8.3 millimeters [mm]; length by width by height [L × W × H]) separated into two blocks (*n* = 12 per block; figs. 1 and 2). Polycarbonate distribution boxes (41.0 × 26.5 × 15.2 centimeters [cm]; L × W × H) were mounted above the test chambers and were used to deliver water and food solution to the test chambers. Polycarbonate head boxes (41.0 × 26.5 × 15.2 cm; L × W × H) were mounted above the distribution boxes and were used to mix the food solution (similar to Meinertz and others, 2011) with the water supply and then to supply a constant flow of food-enriched water to the distribution boxes through glass standpipes (≈ 5 mm inner diameter). Food solutions were delivered to the inflow of each headbox via a peristaltic pump (Masterflex® Digi-staltic drive, model 77310; Cole-Parmer, Vernon Hills, Illinois) fitted with Masterflex L/S 16 tubing (figs. 1 and 2).

Test chamber inflows were controlled through 21-gauge luer-lock dispensing needles attached to 3-milliliter (mL) syringe bodies. The syringe body tips were cut to a length of approximately 3 cm, fitted into silicone stoppers, and then positioned in 19-mm holes in the bottom of the distribution boxes. Well water (20 ± 2 degrees Celsius [°C]) inflow to each test chamber was maintained between 7.0 to 10.0 milliliters per minute to provide a minimum of one test chamber exchange per hour. During the exposure period, water inflow was interrupted and supplemental aeration was supplied to the test chambers. Indirect fluorescent lighting (85 to 405 lux) was provided on an 18 hours light: 6 hours dark cycle as in accordance with ASTM International guidelines (2013).

The test chambers (fig. 3) contained three separate sections; the center section (7.0 × 4.5 × 8.0 cm; L × W × H) was used to house the test animals, and the outer sections (4.5 × 4.5 × 8.0 cm; L × W × H) were used to isolate the water inflow and outflows (fig. 4). The center sections were separated from the outer sections by two glass partitions. Each partition consisted of two identical 0.32-cm-thick glass plates (4.5 × 8 cm; width by height) with two 1.4-cm holes positioned in a horizontal plane approximately 0.8 cm from the bottom (inflow partitions) or 2.5 cm from the bottom (outflow partitions). Nitex® mesh (150 micrometers [µm]) was placed between the partition plates before bonding them with silicone sealant. The Nitex mesh retained the test animals while allowing for water inflow/outflow. Test chambers were uniquely identified to allow for identification of treatment type and replicate.

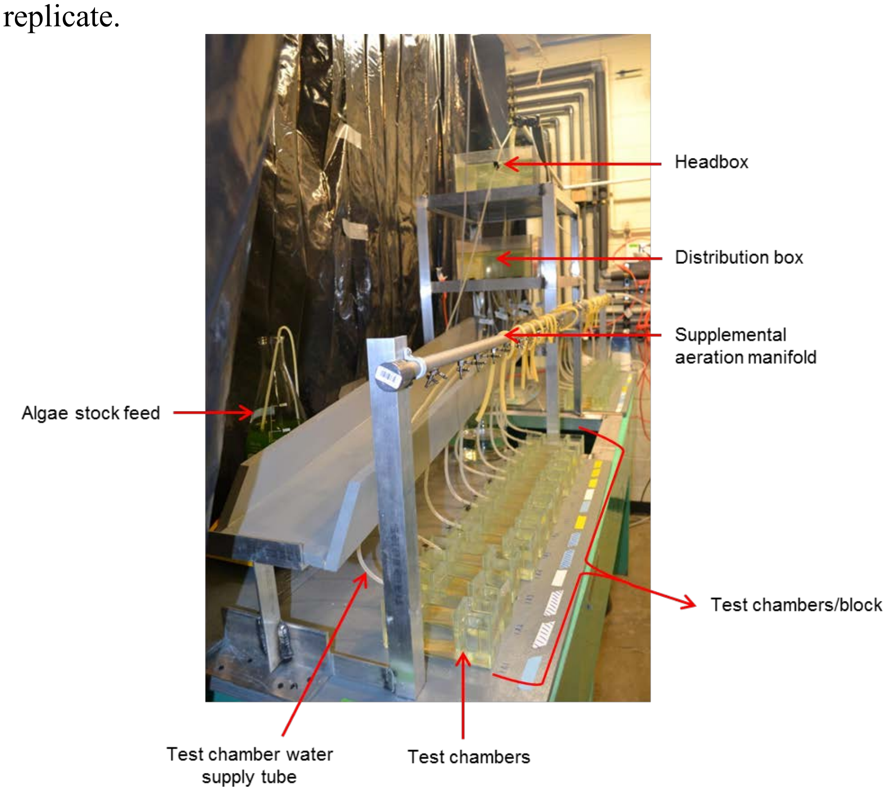

Figure 1. Test system used for dosing juvenile unionid mussels.

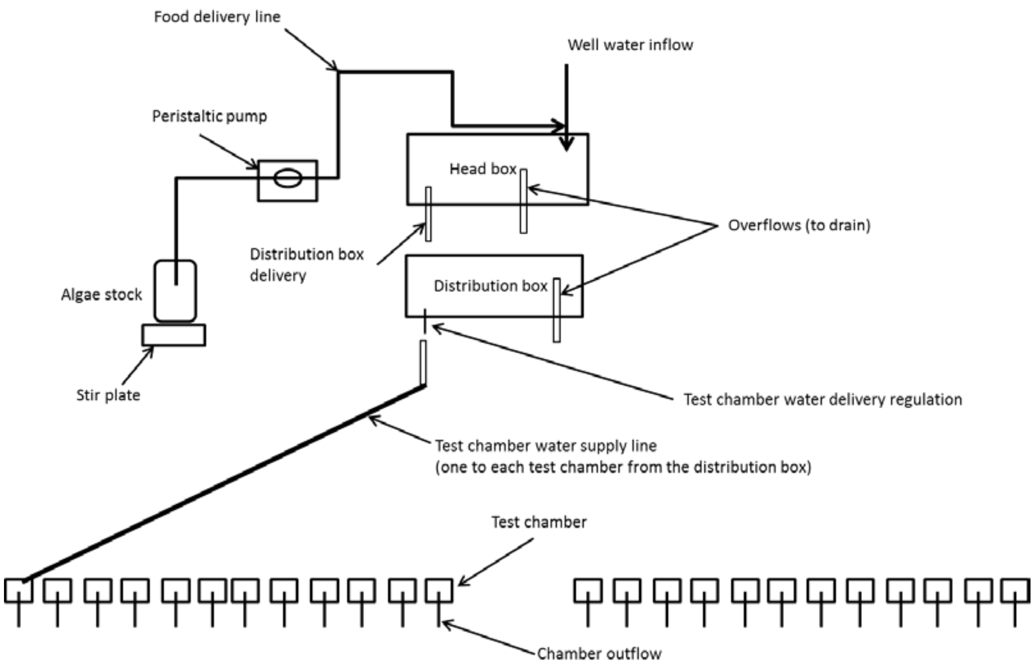

Figure 2. Schematic of test system used for dosing juvenile unionid mussels.

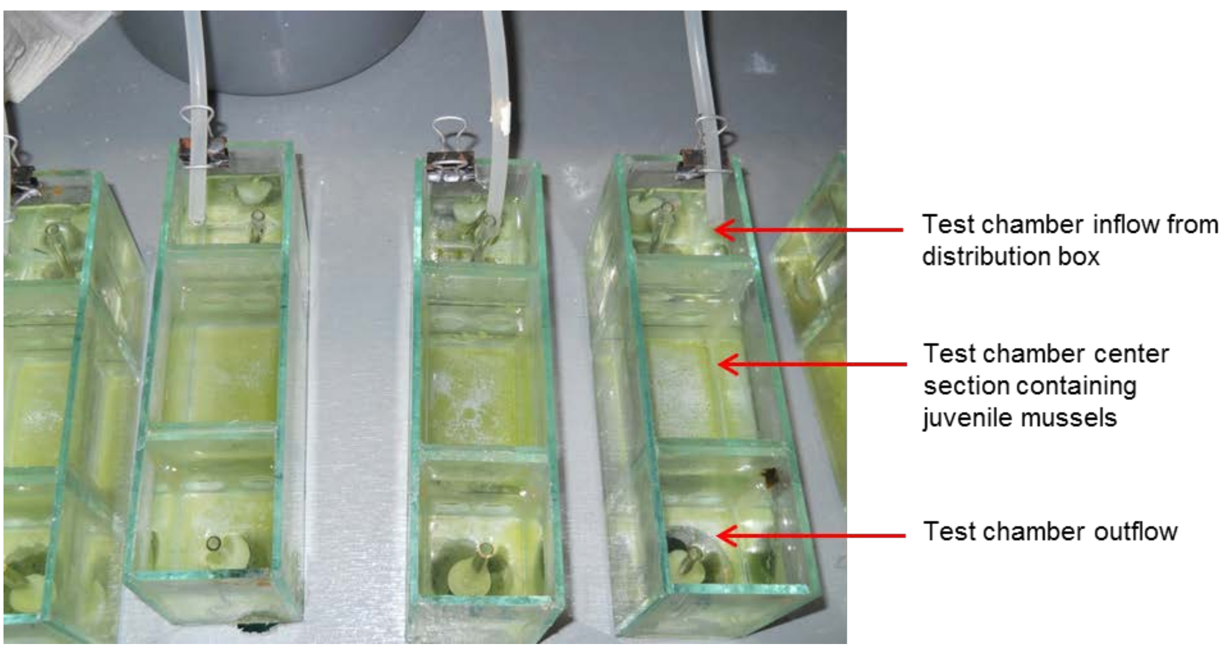

Figure 3. Example of three-section test chambers.

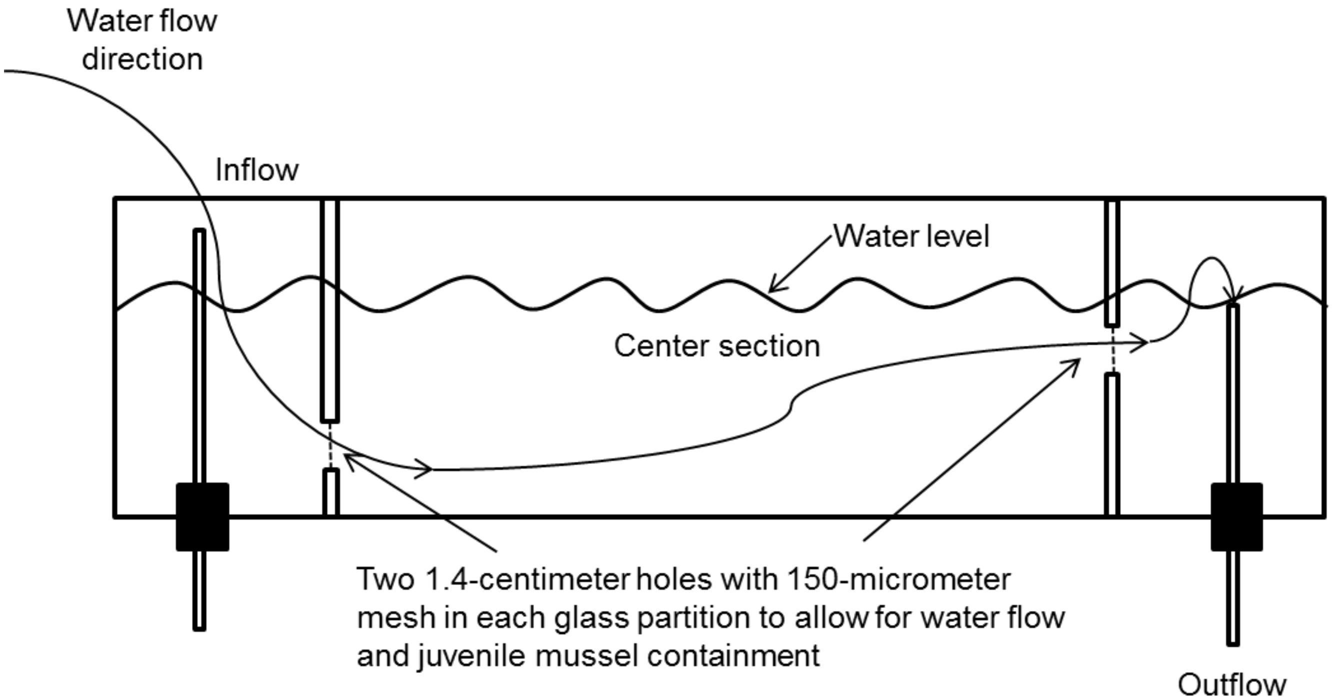

Figure 4. Three-section test chamber schematic: inflow section (left), center section containing juvenile unionid mussels (center), and outflow section (right).

Test Animals

Seven species of newly metamorphosed unionid mussels (excysted < 72 hours) were acquired from the U.S. Fish and Wildlife Service Genoa National Fish Hatchery and used as the test animals (table 1; appendix 5, items 1–15). The unionid mussels were acclimated to test dilution water and temperature through periodic water exchanges prior to transport and upon arrival at UMESC. Unionid mussels were observed under a dissecting microscope (model SMZ745; Nikon Instruments, Melville, New York), and those actively displaying foot movement (fig. 5; n = 960 per species [40 unionid mussels per replicate × 4 replicates × 6 treatment groups]) were randomly distributed to test chambers in groups of 20 until each chamber received a total of 40 unionid mussels. The unionid mussels were distributed to the test chambers ≤ 12 hours prior to exposure initiation by using a pipette with a wide-bore pipette tip to lessen the chances of injury to the animals.

The newly metamorphosed unionid mussels were provided a diet consisting of *Chlorella sorokiniana*, *Tetraselmis*, and *Nannochloropsis* at a nominal target concentration of 2.0 mg/L (algae dry weight). The diet used similar species and quantities that were to be successful for rearing newly metamorphosed juvenile mussels in a continuous flow-through system (Meinertz and others, 2011). A continuous supply of 20 ± 2 °C well water containing the algae food solution was provided to the test chambers during the acclimation and 7-day postexposure holding periods. Algae solutions (3.6 liters [L]) were prepared daily in a 4-L Erlenmeyer flasks. The algae solution contained a 1:1:1 (dry weight) mixture of live chlorella algae (Kentucky Department of Fish and Wildlife Resources, Center for Mollusk Conservation, Frankfort, Kentucky), *Tetraselmis* Instant Algae®, and *Nannochloropsis* Instant Algae®. Instant algae pastes were obtained from Reed Mariculture (Campbell, Calif.). The algae solutions were continuously mixed on stir plates and delivered via a peristaltic pump directly into the water inflow stream for the headboxes at 2.0 ± 0.2 mL/minute. Airstones were placed in the headboxes to assure thorough mixing of the algae solutions with the well-water inflow before delivery to the distribution boxes and test chambers. The resulting algae-enriched water delivered to the test chambers contained the nominal target concentration of 2.0 mg/L (algae dry weight).

Figure 5. Representative juvenile unionid mussels displaying active foot movement. The photograph is of *Lampsilis cardium* juvenile unionid mussels at the end of the 7-day postexposure holding period.

Test Article Solutions

For each species tested, a 10,000-mg/L AI treatment stock solution was prepared by placing either 10 grams SDP or 5 grams FDP in a 500-mL volumetric flask containing well water. A 5-L batch exposure solution was prepared immediately prior to exposure for each treatment group by adding the appropriate amount of the treatment stock solution to well water (appendix 4, items 17–23). The nominal target concentrations of the batch exposure solutions were 50, 100, 200, and 300 mg/L of active ingredient.

On each exposure day, a 10,000-mg/L AI heat-deactivated treatment stock solution was prepared by placing either 10 grams SDP or 5 grams FDP in a 500-mL volumetric flask containing approximately 300 mL of well water. The solution was placed in a 70 °C water bath for 45 minutes to degrade the active components of the *P. fluorescens*, according to the methods developed at the New York State Museum Field Research Laboratory (D. Mayer, Director of the New York State Museum Field Research Laboratory, oral commun., 2010). After cooling, the solution was brought to a final volume of 500 mL with well water. A 5-L batch deactivated exposure solution was prepared for each species by adding 150 mL of the stock solution to 4,850 mL of well water (appendix 4, items 17–23). The nominal target concentration of the batch heat-deactivated exposure solutions was 300 mg/L of active ingredient.

Dosing

Batch exposure solutions were prepared and immediately applied to test chamber replicates in a sequence. Exposures commenced with control treatments followed by the 300 mg/L heat-deactivated (positive control) treatment, then the treatments of 50, 100, 200, and 300 mg/L. Treatments were initiated by interrupting water inflows and then removing the inflow and outflow standpipes to drain the water. After draining, residual water in the test chambers (≈25 mL) was replaced with exposure solution by flushing ≈300 mL of exposure solution through the test chambers. After test-chamber flushing, the standpipes were seated, and the test chambers were filled with exposure solution. Test chambers were supplied with supplemental aeration through disposable glass pipets placed near the bottom center of the test chamber.

At the conclusion of the 24-hour exposure period, the standpipes were removed from the test chambers and the exposure water drained. The chambers were flushed with well water (20 ± 2 °C), and water inflow was restored.

Water Chemistry

Water hardness, alkalinity, conductivity, and total ammonia nitrogen (TAN) were measured prior to exposure on water samples collected from each distribution box. Dissolved oxygen (DO), pH, and temperature also were measured prior to exposure in each distribution box and in two indiscriminately selected test chambers for each species.

Dissolved oxygen, pH, and temperature were measured in the center section of each test chamber at 6, 12, and 24 hours after application of the test article. Immediately after measurement of the water chemistry parameters, water samples (≈5 mL) were collected from the center section of the test chambers for determination of TAN. The samples were filtered through a 0.45-µm syringe filter, acidified to pH ≤ 2.5 with 10 percent sulfuric acid, and stored at ≈4 °C until analyzed for TAN by using the automated phenate method (Standard Method 4500G in American Public Health Association and others, 2012). Upon exposure termination, water hardness, alkalinity, and conductivity were measured in pooled water samples obtained from the center sections of test chamber replicates for each species.

Dissolved oxygen, pH, and temperature were measured daily throughout the 7-day postexposure holding period in two representative test chambers for each species. Water hardness, alkalinity, conductivity, and TAN were measured once during the 7-day postexposure holding period on a representative test chamber for each species.

Survival Assessment

Seven days after exposure, the contents of each test chamber were drained and rinsed through a 150-µm sieve with well water (20 ± 2 °C) to collect the unionid mussels. The contents retained on the sieve were backwashed into a petri dish (100 mm × 150 mm) and viewed under a dissecting microscope to ascertain survival of the mussels. Survival of the recovered unionid mussels was indicated by observation of foot movement. Unrecovered unionid mussels were treated as mortalities within the data analysis.

Data Analysis

Water chemistry (DO, pH, temperature, water alkalinity, water hardness, conductivity, and ammonia) data analyses were limited to simple descriptive statistics calculated by using SAS® software version 9.4 (SAS Institute, Inc., Cary, North Carolina). Un-ionized ammonia fractions were calculated by using the pH and temperature measured at the time of sample collection according to the formula of Emerson and others (1975).

Statistical comparisons of zebra mussel survival also were completed by using SAS® software version 9.4. Significance was declared at $\alpha \leq 0.05$. A generalized linear mixed model was used to analyze the survival of unionid mussels in each treatment group (appendix 8, item 3). The proportion of mortalities ([number of dead + number of unrecovered unionid mussels at the end of postexposure period] compared to the original number of unionid mussels present) was modeled with a binomial distribution and a logit link function. A scale parameter was added to the model by using the random_residual statement. Unionid mussel survival in each treatment group was individually compared to the survival in the untreated control group by using a two-sided means comparison test.

Results

Preexposure water chemistry parameters (DO, pH, and temperature) are summarized in table 2 and in appendix 6 (items 1–8). Dissolved oxygen ranged from 8.33 to 8.79 mg/L, temperature ranged from 19.9 to 21.0 °C, pH ranged from 7.7 to 8.3, water hardness ranged from 172 to 180 mg/L as calcium carbonate ($CaCO_3$), alkalinity ranged from 118 to 130 mg/L as $CaCO_3$, and conductivity ranged from 370 to 396 microsiemens (µS)/cm. The TAN remained ≤ 0.18 mg as NH_3-N/L, and un-ionized ammonia remained ≤ 0.01 mg as NH_3/L.

Exposure period water chemistry parameters (DO, pH, and temperature) are summarized in table 2 and in appendix 6 (items 1–4). Dissolved oxygen remained above the ASTM International (2013) criterion of 4 mg/L throughout the entire testing period. Water hardness, water alkalinity, and conductivity are summarized in table 3 and in appendix 6 (items 1–4). Water chemistry values for pooled exposure termination included water hardness ranges from 178 to 192 mg/L as $CaCO_3$, alkalinity ranges from 141 to 149 mg/L as $CaCO_3$, and conductivity ranges from 382 to 444 µS/cm.

The TAN and un-ionized ammonia from samples collected during the exposure period are summarized in table 4 and in appendix 6 (items 5–8). The TAN remained below the 2013 U.S. Environmental Protection Agency (EPA) criterion of 17 mg/L TAN at pH 7 and 20 °C for acute exposure through 12 hours of the exposure period for all species and treatment groups and through the 24-hour exposure period for all control animals (tables 5b and 6 in EPA, 2013). The TAN in the *L. recta* 300 mg/L heat-deactivated treatment group (4.99 mg/L as NH_3/L; table 4) was the only SDP-treatment group that exceeded the acute criterion. The TAN observed in the *O. olivaria* and *A. ligamentina* 100, 200, 300 mg/L FDP-treatment groups and 300 mg/L heat-deactivated FDP-treatment group (range from 3.50 to 11.66 mg/L as NH_3/L, table 4) exceeded the acute criterion at 24 hours. In addition, the TAN observed in the *M. nervosa* 200 and 300 mg/L FDP-treatment groups and 300 mg/L heat-deactivated FDP-treatment group (ranged from 5.39 to 7.09 mg/L as NH_3/L; table 4) also exceeded the acute criterion.

The 7-day postexposure holding period water chemistry parameters are summarized in tables 2 and 3 and in appendix 6 (items 9–12). Dissolved oxygen ranged from 7.93 to 8.41 mg/L, temperature ranged from 19.6 to 20.4 °C, pH ranged from 8.0 to 8.2, water hardness ranged from 174 to 178 mg/L as $CaCO_3$, alkalinity ranged from 121 to 131 mg/L as $CaCO_3$, and conductivity ranged from 363 to 402 µS/cm. The TAN remained ≤ 0.10 mg as NH_3-N/L, and un-ionized ammonia remained ≤ 0.01 mg as NH_3/L.

Unionid mussel recovery and survival are summarized in table 5 and in appendix 8 (items 1–4). The recovery of unionid mussels from individual test chambers ranged from 70 to 100 percent. Multiple factors may have been responsible for unionid mussel recoveries of < 100 percent. First, unionid mussels may have been injured in the initial handling and placement process, during which unionid mussels were handled with a disposable pipet at least twice. If the injury resulted in mortality, then the valves may have degraded to the point of being indiscernible during the survival assessment. Secondly, the valves of newly metamorphosed unionid mussels are very fragile, and they may have been damaged during the collection process when they were rinsed on a sieve before being rinsed into a petri dish.

Mean survival of the SDP-control groups ranged from 25.0 percent (*L. recta*) to 87.5 percent (*L. siliquoidea).* Survival of the SDP-treated groups varied between species; however, exposures up to the maximum label concentration of SDP-formulated *P. fluorescens* (100 mg/L AI) for up to three times the labeled exposure duration (8 hours) resulted in significant differences in survival for only *L. cardium* and *L. recta*. Significant differences in *L. cardium* survival were detected between the control group and all treatment groups. A significant difference in *L. recta* survival was detected between the control group and the 100-mg/L treatment group. Although no other differences were detected in mean survival of *L. recta* treated groups compared to the control group, the low survival of the control group (25.0 percent) indicates that the results should be interpreted with caution. Mean survival of *L. siliquoidea* in the 200 AI, 300 AI, and 300-mg/L heat-deactivated treatment groups was significantly lower than that of the control group. Differences were detected in the mean survival between the 200- and 300-mg/L SDP-treatment and control treatment groups for *L. higginsii*.

Mean survival of the FDP control groups ranged from 71.9 percent (*O. olivaria*) to 88.1 percent (*M. nervosa*). With the exception of the *O. olivaria* and *M. nervosa* 300-mg/L FDP-treatment groups, mean survival in all of the *M. nervosa, O. olivaria,* and *A. ligamentina* FDP-treated groups did not significantly differ from the control groups. Mean survival of the *O. olivaria* 300-mg/L FDP-treated group was significantly lower (p = 0.01) than the control group. Mean survival in the *O. olivaria* 50-, 100-, and 200-mg/L FDP-treatment groups and the 300-mg/L heat-deactivated FDP-treatment group did not differ from that of the control group. The mean survival of the *M. nervosa* 300-mg/L FDP-treated group was significantly lower (p < 0.01) than that of the control group.

Table 2. Mean (standard deviation) dissolved oxygen, temperature, and pH range by treatment group during the preexposure, exposure, and holding periods.

[mg/L, milligrams per liter; FDP, freeze-dried powder; SDP, spray-dried powder; HIC, hickorynut; MUC, mucket; WAS, washboard; PPB, plain pocketbook; FAM, fatmucket; HGE, Higgins' eye; BLS, black sandshell; DO dissolved oxygen; Temp, temperature; °C, degrees Celsius; 300 HD, 300 mg/L of heat-deactivated product]

Sampling period	Water quality parameter	Treatment group (mg/L)	FDP formulation			SDP formulation			
			HIC	MUC	WAS	PPB	FAM	HGE	BLS
Pre–exposure	DO (mg/L)		8.33	8.77	8.70	8.33	8.50	8.79	8.77
	pH		8.21	8.24	8.20	8.10	7.68	8.22	8.32
	Temp (°C)		21.0	20.6	20.1	20.7	20.8	20.5	19.9
Exposure	DO (mg/L)	Control	8.6 (0.2)	8.7 (0.3)	8.5 (0.2)	8.7 (0.1)	8.7 (0.1)	8.5 (0.1)	8.7 (0.2)
		50	8.3 (0.3)	8.5 (0.1)	8.3 (0.3)	8.6 (0.2)	8.5 (0.2)	8.3 (0.2)	8.8 (0.1)
		100	7.9 (0.9)	8.5 (0.2)	8.3 (0.2)	8.4 (0.5)	8.5 (0.1)	8.3 (0.3)	8.5 (0.4)

Sampling period	Water quality parameter	Treatment group (mg/L)	FDP formulation			SDP formulation			
			HIC	MUC	WAS	PPB	FAM	HGE	BLS
		200	8.0 (0.8)	8.4 (0.1)	8.1 (0.4)	8.0 (0.8)	8.2 (0.6)	7.9 (0.7)	8.1 (0.7)
		300	7.4 (1.2)	8.2 (0.4)	7.8 (0.6)	8.0 (0.8)	7.8 (1.0)	7.7 (0.9)	7.8 (1.2)
		300 HD	7.7 (1.0)	8.0 (0.4)	8.1 (0.6)	8.1 (0.8)	7.8 (1.0)	8.0 0.6)	8.0 1.0)
	pH	Control	8.20–8.35	8.12–8.35	8.05–8.27	8.28–8.38	7.98–8.35	8.13–8.40	8.02–8.43
		50	8.19–8.27	8.14–8.26	7.96–8.23	8.21–8.36	7.99–8.28	8.10–8.28	8.04–8.33
		100	8.06–8.20	8.09–8.30	7.99–8.20	8.00–8.34	7.98–8.23	8.15–8.30	7.99–8.32
		200	8.08–8.21	8.04–8.23	7.93–8.08	7.96–8.31	7.92–8.17	7.91–8.11	7.95–8.07
		300	7.95–8.11	7.98–8.12	7.85–7.99	7.97–8.34	7.81–8.03	7.81–8.13	7.84–8.05
		300 HD	7.97–8.06	7.93–8.01	7.82–8.01	7.88–8.37	7.80–8.12	7.97–8.14	7.85–8.15
	Temp (°C)	Control	19.2 (0.9)	19.1 (0.8)	19.6 (0.3)	19.9 (0.2)	19.1 (0.2)	19.8 (0.3)	19.5 (0.2)
		50	19.3 (0.9)	19.1 (0.8)	19.6 (0.2)	19.7 (0.1)	19.1 (0.1)	19.9 (0.2)	19.6 (0.2)
		100	19.2 (0.9)	19.1 (0.7)	19.7 (0.2)	19.6 (0.1)	19.1 (0.1)	19.9 (0.2)	19.6 (0.3)
		200	19.2 (0.9)	19.2 (0.6)	19.6 (0.2)	19.8 (0.2)	19.0 (0.3)	19.9 (0.2)	19.7 (0.3)
		300	19.1 (0.8)	19.1 (0.6)	19.6 (0.3)	19.8 (0.2)	19.0 (0.3)	20.0 (0.3)	19.5 (0.2)
		300 HD	19.3 (0.9)	19.0 (0.7)	19.6 (0.2)	19.7 (0.1)	19.0 (0.2)	20.0 (0.1)	19.6 (0.2)
Holding	DO (mg/L)		7.93	7.93	8.19	8.28	8.09	8.16	8.41
	pH		8.22	8.24	8.13	8.12	8.01	8.20	8.20
	Temp (°C)		19.6	19.8	19.9	20.4	20.3	20.4	20.0

Table 3. Mean (standard deviation) alkalinity, water hardness, and conductivity of preexposure and exposure termination water samples.

[Alk., alkalinity as $CaCO_3$; Hard., hardness as $CaCO_3$; $CaCO_3$, calcium carbonate; Cond., conductivity; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; HIC, hickorynut; MUC, mucket; WAS, washboard; PPB, plain pocketbook; FAM, fatmucket; HGE, Higgins' eye; BLS, black sandshell]

Species	Preexposure			Exposure termination[1]			Holding period		
	Alk. (mg/L)	Hard. (mg/L)	Cond. (µS/cm)	Alk. (mg/L)	Hard. (mg/L)	Cond. (µS/cm)	Alk. (mg/L)	Hard. (mg/L)	Cond. (µS/cm)
HIC	118	172	374	147 (15)	180 (4)	427 (35)	129	178	386
MUC	130	179	371	149 (15)	179 (3)	444 (37)	131	178	390
WAS	125	178	387	148 (12)	189 (2)	429 (29)	121	178	402
PPB	128	172	372	143 (10)	181 (2)	382 (5)	126	174	364
FAM	126	180	396	148 (12)	192 (7)	430 (24)	123	175	383
HGE	128	174	370	141 (8)	178 (2)	390 (18)	121	178	363
BLS	125	180	376	146 (13)	183 (1)	409 (18)	121	176	378

[1] Exposure termination parameters were measured on pooled water samples for each treatment group.

Table 4. Mean (standard deviation) total ammonia nitrogen (TAN) and un-ionized ammonia (NH_3) at 24 hour during the exposure period.

[FDP, freeze-dried powder; SDP, spray-dried powder; HIC, hickorynut; MUC, mucket; WAS, washboard; PPB, plain pocketbook; FAM, fatmucket; HGE, Higgins' eye; BLS, black sandshell; TAN, total ammonia nitrogen; < , less than; mg NH_3-N/L, milligrams un-ionized ammonia nitrogen per liter; 300 HD, 300 mg/L of heat-deactivated product; NH_3, un-ionized ammonia; mg/L milligrams per liter]

Water quality parameter	Treatment group (mg/L)	FDP formulation			SDP formulation			
		HIC	MUC	WAS	PPB	FAM	HGE	BLS
TAN (mg NH_3-N/L)	0	0.02 (0.01)	0.01 (<0.01)	0.03 (0.02)	0.08 (0.03)	0.08 (0.02)	0.06 (<0.01)	0.07 (0.01)
	50	1.26 (0.08)	1.36 (0.11)	1.32 (0.38)	0.29 (0.10)	0.72 (0.15)	0.21 (0.10)	0.19 (0.02)
	100	3.50[a] (0.26)	3.71[a] (0.82)	2.56 (0.19)	0.66 (0.35)	1.47 (0.12)	1.22 (0.54)	2.16 (1.21)
	200	7.80[a] (0.72)	8.30[a] (1.47)	5.39[a] (1.02)	1.06 (0.79)	3.15 (0.42)	2.22 (0.51)	3.13 (1.90)
	300	10.50[a] (1.12)	11.45[a] (1.21)	6.81[a] (1.32)	1.30 (0.93)	4.23 (0.72)	2.50 (0.82)	4.26 (0.51)
	300 HD	11.66[a] (0.26)	10.67[a] (0.43)	7.09[a] (2.04)	1.29 (0.96)	4.15 (0.68)	3.53 (0.44)	4.99[a] (0.13)
NH_3 (mg/L)	0	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	0.01 (<0.01)	0.01 (<0.01)	0.01 (<0.01)	0.01 (<0.01)
	50	0.07 (0.01)	0.08 (0.01)	0.07 (0.03)	0.02 (0.01)	0.04 (0.01)	0.01 (0.01)	0.01 (<0.01)
	100	0.16 (0.02)	0.22 (0.04)	0.11 (0.03)	0.04 (0.02)	0.08 (0.01)	0.08 (0.04)	0.13 (0.08)
	200	0.37 (0.07)	0.41 (0.10)	0.19 (0.05)	0.04 (0.03)	0.13 (0.04)	0.08 (0.03)	0.13 (0.08)
	300	0.36 (0.07)	0.46 (0.09)	0.19 (0.03)	0.05 (0.03)	0.13 (0.05)	0.08 (0.05)	0.15 (0.04)
	300 HD	0.40 (0.03)	0.35 (0.01)	0.22 (0.02)	0.06 (0.05)	0.14 (0.03)	0.15 (0.02)	0.21 (0.06)

[a] TAN values exceed the acute exposure criterion (tables 5b and 6, U.S. Environmental Protection Agency, 2013).

Table 5. Mean (standard deviation) recovery and percent survival of unionid mussels exposed to spray-dried powder (SDP) or freeze-dried powder (FDP), by formulation type and treatment group.

[Survival treatment means within the same column with letters are significantly different ($p > 0.05$) from the control means; mg/L, milligrams per liter; FDP, freeze-dried powder; SDP, spray-dried powder; HIC, hickorynut; MUC, mucket; WAS, washboard; PPB, plain pocketbook; FAM, fatmucket; HGE, Higgins' eye; BLS, black sandshell]

	Treatment group (mg/L)	FDP formulation			SDP formulation			
		HIC	MUC	WAS	PPB	FAM	HGE	BLS
Recovery	Control	88.1	89.4	96.9	91.3	91.3	93.1	93.1
		(4.7)	(10.1)	(1.3)	(5.2)	(2.5)	(5.5)	(5.5)
	50	88.8	93.8	92.5	90.6	91.3	88.1	93.1
		(12.7)	(4.3)	(5.4)	(5.2)	(5.2)	(8.8)	(2.4)
	100	90.0	90.0	94.4	91.3	96.3	92.5	92.5
		(8.4)	(10.2)	(3.8)	(7.5)	(3.2)	(6.5)	(5.4)
	200	90.6	94.4	96.3	91.9	91.9	86.3	93.8
		(5.2)	(4.7)	(6.0)	(3.8)	(2.4)	(13.8)	(6.0)
	300	94.4	93.8	96.3	90.0	91.9	87.5	93.1
		(8.3)	(1.4)	(1.4)	(7.4)	(2.4)	(9.4)	(5.5)
	300HD	88.1	94.4	94.4	90.0	91.3	94.4	95.0
		(5.9)	(2.4)	(5.2)	(3.5)	(4.3)	(3.1)	(0.0)
Survival	Control	71.9	78.8	88.1	68.8	87.5	88.1	25.0
		(9.4)	(10.3)	(5.9)	(9.7)	(3.5)	(9.7)	(13.4)
	50	65.0	78.1	77.5	14.4[a]	75.6	79.4	21.3
		(20.3)	(6.3)	(6.1)	(7.7)	(13.8)	(9.0)	(18.1)
	100	67.5	75.0	86.3	18.8[a]	86.3	78.8	6.3[a]
		(15.9)	(11.5)	(6.6)	(10.1)	(6.0)	(4.8)	(2.5)
	200	52.5	70.0	80.0	26.9[a]	50.6[a]	65.6[a]	8.1
		(23.0)	(10.2)	(9.6)	(20.9)	(21.2)	(13.8)	(6.3)
	300	38.1[a]	73.8	48.1[a]	18.8[a]	3.8[a]	61.9[a]	13.8
		(14.0)	(10.3)	(11.3)	(14.2)	(3.2)	(6.6)	(4.8)
	300HD	53.1	81.9	76.3	40.6[a]	30.0[a]	75.6	6.9
		(11.8)	(3.1)	(10.3)	(20.0)	(35.5)	(12.3)	(12.1)

Conclusion

The study results indicate that exposure to spray-dried powder formulated *Pseudomonas fluorescens* at the maximum-labeled concentration (100 milligrams per liter [mg/L] active ingredient [AI]) and up to three times the maximum-labeled exposure duration (8 hours) is not likely to affect the survival of newly metamorphosed *Lampsilis siliquoidea* and *Lampsilis higginsii*. The low mean survival of the *Ligumia recta* control group (25.0 percent) indicates that results for *L. recta* should be interpreted with caution. Significant differences were detected in the mean survival of the *Lampsilis cardium* treated groups (14.4 to 40.6 percent) compared to the control group (68.8 percent). The results indicate that further investigation on the effects of spray-dried powder formulated *P. fluorescens* exposure on *L. recta* and *L. cardium* is warranted.

Mean survival of three unionid mussels species exposed to the freeze-dried powder formulated *Pseudomonas fluorescens* was not significantly different in the 50-, 100-, and 200-mg/L AI treatment groups and the 300-mg/L heat-deactivated treatment groups when compared to the control groups. The study results indicate that exposure to freeze-dried powder formulated *Pseudomonas fluorescens* up to 200 mg/L AI and up to 24 hours is not likely to impact the survival of newly metamorphosed *Obovaria olivaria*, *Actinonaias ligamentina*, and *Megalonaias nervosa*.

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Appendix 1. Study Protocol With Data Forms

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3	Note to File 2: Clarify use of two Water Quality Form 2 datasheets for Hickorynut mussel test	1	51
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7	Amendment 4: Changes software used to capture, record, and analyze photomicrographs to Nikon Elements BR® software	2	58
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ORIGINAL

Protocol Title:

Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Study Number: AEH-11-PSEUDO-02

Test Facilities and Study Sponsor

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US Geological Survey
2630 Fanta Reed Rd.
La Crosse, Wisconsin 54603

Proposed Experimental Start Date: May 2011
Proposed Experimental Termination Date: March 2012

Protocol Approval

Reviewed by:

[redacted] 25 May 2011
Mark P. Gaikowski, M.A. Date
Supervisory Biologist

[redacted] 27 May 2011
Jane E. Rivera Date
Acting Quality Assurance Officer

[redacted] 26 May 2011
for Michael D. Jawson, Ph.D. Date
Center Director

Approved by:

[redacted] 26 MAY 2011
James A. Luoma, B.A. Date
Study Director

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ORIGINAL

1. INTRODUCTION:

Historical native freshwater mussel populations of North America were considered the most diverse in the world with about 297 recognized taxa consisting of 281 species and 16 subspecies (Williams et al., 1993). Mussels are largely sedentary in nature, relying on movement of host fish during glochidial attachment as means of transport. Due to these facts, mussels are particularly vulnerable to a variety of anthropogenic influences including habitat degradation and alteration, pollution and over harvest. Master (1990) reported a survey conducted by the Nature Conservancy which showed 55% of North America's mussels as extinct or imperiled compared to 7% of terrestrial species which traditionally have received far greater attention. Ricciardi and Rasmussen (1999) projected that at least 127 imperiled mussel species will be lost in the next 100 years. The extinction rate was calculated to be 6.4% per decade and should be considered conservative because it did not take into account the extirpations caused by the invasive dreissenid mussels (Ricciardi and Rasmussen, 1999).

Neves et al (1997) reported the ominous status of native mussels in the Southeast with only 25 percent of the 269 species historically present reported as stable. Thirteen percent were reported as presumed extinct, 28 percent as endangered, followed by 14 percent as threatened and 18 percent listed as species of special concern. Many unionid mussel species in North America were imperiled prior to epizoic colonization by zebra mussels (*Dreissena polymorpha*), which has dramatically heightened concerns for their continued survival. Zebra mussels have been deemed responsible for the extirpation of unionids from waters in Europe as early as 1937 (Sebestyen, 1937). Severe declines in unionid abundance in Europe (Karatayev and Burlakova, 1995; Burlakova, 1998) and North America (Haag et al, 1993; Nalepa, 1994; Ricciardi et al., 1996) have since been well documented in the literature.

The 1973 Endangered Species Act (ESA) brought forth the need to recognize, protect and recover rare mussels in the United States. The United States Fish and Wildlife Service (USFWS) develops recovery plans for threatened and endangered species which utilize a range of tools to promote recovery of the species including restoring and acquiring critical habitat, removing introduced or invasive species and captive propagation and release into historic ranges.

As of 2004, mussel propagation work was being conducted in several different facilities in 7 states as well as in Ontario, Canada (Neves, 2004). The Genoa National Fish Hatchery (GNFH) in Wisconsin has been involved in mussel recovery since 2000, releasing tens of thousands of propagated subadult Higgins eye pearlymussel (*Lampsilis higginsii*) for recovery efforts. The GNFH produces subadult mussels using cage culture techniques. This technique involves placing glochidia laden host fish into submerged cages within natural water bodies such as the Upper Mississippi and St. Croix Rivers. The fish are released from the cages after mussel excystment and the mussels are allowed to grow on the cage bottom for an additional 6-18 months before being harvested. Areas that were previously successful in rearing mussels using this technique have been abandoned due to the proliferation and colonization by zebra mussels.

Biologists at the New York State Museum (NYSM) Field Research Laboratory have been researching dreissenid mussel control since 1991 and they discovered that a bacterium isolated from soils (*Pseudomonas fluorescens* [Pf-CL145A]) is efficacious for controlling zebra mussels. Marrone Bio Innovations (MBI; Davis, CA) is currently developing a freeze dried formulation of this bacterium called MBI-401 FDP. The current commercial applications of this product are for use with closed systems such as power generating plant cooling systems. The NYSM has partnered with the USFWS (Genoa NFH) and United States Geological Survey's (USGS) Upper Midwest Environmental Sciences Center (UMESC) to determine the suitability of this product for open water zebra mussel control applications such as treatment of native mussel propagation cages or native mussel beds.

The newly metamorphosed life stage of unionid mussels has been identified as a critical life stage that has unique life style characteristics that may not be adequately safe guarded by habitat protections designed for adult lifestages (ASTM E2455-06). This research will determine the animal effects of various concentrations of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juveniles from seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.

2. PROTOCOL OBJECTIVE:

This study will determine the animal effects of various concentrations of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) to the newly metamorphosed lifestage of seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.

3. STUDY SCHEDULE:

3.1 Proposed initiation: May 2011

3.2 Schedule of events: A proposed schedule of events is provided in Table 1.

3.3 Proposed completion date: March 2012

Table 1. Proposed Schedule of Events

Date	Activity
May 2011-December 2011	mussel exposures
November 2011-February 2012	Data analysis
March 2012	Final Report submission

4. STUDY DESIGN:

4.1 General Description:

Newly metamorphosed juvenile mussels from 7 unionid mussel species (Table 2) endemic in the Great Lakes and Mississippi River basins will be evaluated for effects from exposure to varying concentrations of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]). Juvenile mussels will be placed into a flow through test apparatus and then exposed to the test material for 24 h in a static exposure. Following the exposure period, the water flow will resume to the exposure chambers and the mussels will be reared for an additional 30 days before being removed from the system and evaluated for survival and growth. The mussels will be preserved for possible histological examination. If histological examination is deemed necessary, a protocol amendment will be prepared to describe the methods and procedures to be used.

Table 2. Mussel species to be evaluated for MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) exposure effects.

Common name	Scientific name
Black sandshell	*Ligumia recta*
Fatmucket	*Lampsilis siliquoidea*
Hickorynut	*Obovaria olivaria*
Higgins eye	*Lampsilis higginsii*
Mucket	*Actinonaias ligamentina*
Plain pocketbook	*Lampsilis cardium*
Washboard	*Megalonaias nervosa*

4.2 Experimental Design:

Donor mussel collection, host fish inoculation, and newly metamorphosed mussels harvesting will be performed at the Genoa NFH by USFWS biologists. Gravid donor mussels will be collected from the Upper Iowa, Upper Mississippi or

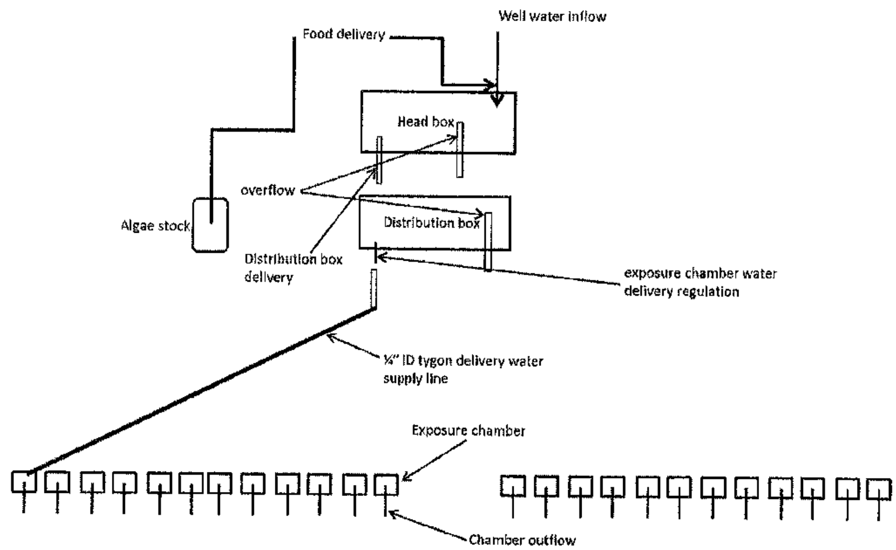
St. Croix Rivers. Mussels will be identified to species as described in Cummings and Mayer (1992) and Watters et al. (2009) by staff at the Genoa NFH. Approximately 1,200 juvenile mussels from each species will be collected from the mussel propagation aquaria by Genoa NFH biologists and transferred to the UMESC at ~20°C. After acclimation to UMESC test water, the mussels will be placed in petri dishes and viewed under a dissecting microscope. Twenty mussels displaying active foot movement will be transferred with a disposable pipet into a 50-mL beaker or petri dish containing 20°C well water. The beaker or petri dish will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water and approximately 4 mm of 75 – 150 µm silica sand as substrate. The process will then be repeated until all exposure chambers receive a total of two distribution aliquots for a total of 40 juveniles for each exposure chamber. Additionally, two randomly chosen groups of 20 mussels of each species will be preserved to determine the initial mussel valve length.

Exposures will be initiated 12-24 h after the exposure chambers receive test animals by interrupting the fresh water flow and then adding the appropriate freshly prepared solution of MBI-401 FDP in a completely randomized design. There will be a total of four replicates for each exposure concentration, for a total of 24 exposure chambers per species (Figure 1). The exposure chambers will be held at 20°C on an 18:6 h light/dark cycle for the exposure and post exposure period. The exposure will be a single, dose of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) administered as a 24 h static exposure. Water flow will be resumed to the exposure chambers after the treatment period.

At 30-d post exposure, the contents of each exposure chamber will be sieved through a 200-µm screen to separate the juvenile mussels from the substrate. The mussels will be examined through a dissecting scope to determine viability and for enumeration. A photomicrograph of all surviving mussels will be recorded for each exposure chamber for growth measurements. The mussels will be euthanized and fixed in modified Davidson's solution for up to 48 h and then transferred to 70% ethanol.

ORIGINAL

Figure 1. Schematic of mussel exposure system



5. STUDY PROCEDURES

5.1 Test Animals

5.1.1 Description:

5.1.1.1 Age – 24 -72 h newly excysted mussels.

5.1.1.2 Sex – The sex of newly excysted mussels cannot be determined visually.

5.1.1.3 Species – See Table 2

5.1.2 Number of animals: Approximately 960 mussels (40 per replicate x 4 replicates x 6 concentrations) of each species. This design uses the fewest number of mussels possible, consistent with the objective of the study, contemporary scientific standards and ASTM guide E2455-06.

5.1.3 Source of animals: All mussels will be obtained from the Genoa NFH.

5.1.4 Inclusion criterion: Mussels will be used only if they display active foot movement.

5.1.5 Acclimation: Mussels will be acclimated to UMESC well water and temperature (20°C) by the addition of approximately 50% UMESC well water at the Genoa NFH prior to transport to UMESC and again after arrival at the UMESC.

5.1.6 Feeding: After the exposure period, the exposure chambers will receive a constant supply of well water containing approximately 2.25 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

5.2 Water Chemistry

5.2.1 Dissolved oxygen: Dissolved oxygen will be measured and recorded prior to test initiation and at least twice during the exposure period in the control and exposure concentrations. Additionally, the dissolved oxygen will be measured and recorded daily throughout the holding period in one representative exposure chamber for each species. (UMESC SOP AEH 394 or equivalent).

5.2.2 Temperature: Temperature will be measured and recorded prior to test initiation and at least twice during the exposure period in the control and exposure concentrations. Additionally, the temperature will be measured and recorded daily throughout the holding period in one representative exposure chamber for each species.

5.2.3 pH: The pH will be measured and recorded prior to test initiation and at least twice during the exposure period in the control and exposure concentrations. Additionally, the pH will be measured and recorded daily throughout the holding period in one representative exposure chamber for each species. (UMESC SOP AEH 335 or equivalent).

5.2.4 Hardness: The hardness will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples from the control and high concentrations. Additionally, the hardness will be measured weekly throughout the holding period on one representative exposure chamber for each species (UMESC SOP AEH 712).

5.2.5 Alkalinity: The alkalinity will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples from the control and high concentrations. Additionally, the alkalinity will be measured weekly throughout the holding period on one representative exposure chamber for each species (UMESC SOP AEH 706).

5.2.6 Conductivity: The conductivity will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples of each test concentration. Additionally, the conductivity will be measured weekly throughout the holding period on one representative exposure chamber for each species(UMESC SOP AEH 188 or equivalent).

5.2.7 Ammonia: The total ammonia will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples of each test concentration. Additionally, the ammonia will be measured weekly throughout the holding period on one representative exposure chamber (UMESC SOP AEH 301 or equivalent). Unionized ammonia will be calculated from the total ammonia, pH and temperature of the samples.

5.3 Disposal: Upon study termination the mussels in each test vessel will be euthanized by MS-222 overdose after enumeration for survival and photomicrograph records are completed for growth analysis but prior to preservation for possible histological examination (UMESC SOP GEN 132).

5.4 Study facilities:

5.4.1Test Facility

U.S. Geological Survey, Upper Midwest Environmental Sciences Center
2630 Fanta Reed Rd
La Crosse, Wisconsin 54603

5.4.1.1 Exposure system: The test system is a series of 24 aquaria (17.8 x 5.1 x 8.3 mm) for each species. Each exposure vessel will receive a continuous supply of 20°C well water from a distribution box (see Figure 1). Each chamber will be uniquely identified (eg: 1A2) to allow for identification of species treatment type and replicate number. Coding procedures will be documented in the laboratory notebook.

5.4.1.2 Aeration: Supplemental aeration will be supplied during exposures by gently bubbling in laboratory air through a pasteur pipet at a rate of approximately 1 bubble/second.

5.4.1.3 Water supply: Temperature adjusted well water (20°C) will be supplied continuously at a rate to provide approximately 1 chamber exchange per hour. During the 24 h exposure period, water to the chambers will be discontinued and the chambers will be static.

5.4.1.4 Lighting: Direct light may adversely affect test results, thus indirect lighting(~18 h L:6 h D; 100-1000 lux) will be provided; light intensity will be recorded at the initiation and prior to the completion of the exposure period (UMESC SOP AEH 308).

5.4.1.5 Exposure chamber dimensions: The exposure chambers are (17.8 x 5.1 x 8.3 mm) glass aquaria. Each exposure chamber will contain approximately 380 mL of well water and 35g of substrate.

5.4.1.6 Water discharge: All water will be discharged into the UMESC invasive species isolation facility.

5.5 Observations:

5.5.1 Survival and growth: Survival will be determined by observing foot movement, heart beat or ciliary movement. Growth will be determined by comparing valve length measurements from photomicrograph records captured and analyzed using Image Pro® Express software. Comparisons will be made between treatments as well as to mussel images recorded prior to the test initiation.

5.6 Treatment administration:

5.6.1 Treatment: Each species of mussels will be exposed to four replicates of either 0 (control), 50, 100, 200 or 300 mg/L and a 300 mg/L heat deactivated (70°C/45 minutes) control as a single dose exposure.

5.6.2 Route of administration: Exposures will be initiated by addition of an appropriate freshly prepared solution of MBI-401 FDP in a completely randomized design. The test concentrations will include 0 (control), 300 mg/L deactivated (positive control), or 50, 100, 200, or 300 mg/L of active MBI-401 FDP. To assure proper concentration levels, the exposure chamber water volume will be lowered as far as possible and the chamber will be flushed with the treatment solution before refilling to the original volume.

5.6.3 Dose verification: The activity of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) cannot be assessed by current analytical techniques as the chemical nature of the active agent in the bacterium has not been determined or characterized. Dosage verification of MBI-401 FDP will be assessed by measuring and recording the absorbance of the prepared stock dosing solution and the high treatment concentrations with a Beckman DU 800 UV/Vis spectrophotometer (UMESC SOP AEH 303). The collected absorbance information will be used to determine inter- and intra-test variability in the preparation of stock and test solutions.

6. SPECIFICATION OF VARIABLES

6.1 Distribution to experimental units: Twenty mussels displaying active foot movement will be transferred with a disposable pipet to a 50 mL beaker containing 20°C well water. The beaker will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water with approximately 4 mm of 75 – 150 μm silica sand as substrate. This procedure will then be repeated until all chambers receive 40 mussels in two aliquots. The exposure chambers will be randomly assigned treatment concentration.

6.2 Determination of survival and growth: Survival of recovered mussels will be determined by observing foot movement, heart beat or ciliary movement. Growth will be determined by comparing valve length measurements from photomicrograph records captured and analyzed using Image Pro® Express software. Comparisons will be made between treatments as well as to mussel images recorded prior to the test initiation.

7. DATA ANALYSIS

7.1 Experimental unit: The experiment unit will be the exposure chamber.

7.2 Number of exposures and replicates: There will be a total of 6 treatment levels (control, positive control (heat treated *Pf*-CL145A) 50, 100, 200 and 300 mg *Pf*-CL145A/L) and four replicate exposure chambers per treatment level for a total of 24 exposure chambers for each mussel species.

7.3 Statistical methodology:

Survival data will be analyzed using a generalized linear mixed model (SAS PROC GLIMMIX). In every analysis, the exposure chamber will be treated as the experimental unit. The change in proportion of survival will be analyzed using a generalized linear mixed model where the distribution is binomial and the link used is the logit function.

If a significant effect of treatment is identified then pairwise comparison tests will be completed to compare each treatment group to the control group using unadjusted least squares means.

7.4 Statistical significance: Statistical significance will be declared at $p < 0.05$.

7.5 Other data analyses: Statistical methods for other study data collected will include calculation of means, standard deviations and coefficients of variation.

8. PERSONNEL

8.1 Study Director: James A. Luoma, B.A.

8.1.1 Address: Upper Midwest Environmental Sciences Center, US Geological Survey, 2630 Fanta Reed Rd., La Crosse, Wisconsin 54603

8.1.2 Contact: Tel: (608) 781-6391, Fax: (608) 783-6066; jluoma@usgs.gov

8.1.3 Training and experience: CV on file at UMESC.

8.2 Other personnel involved in study: Technical staff involved in the study will be identified in the study raw data to include study function. UMESC technical staff training and experience will be documented in CVs included in the study raw data.

9. DISPOSITION/STORAGE

9.1 Study Records: All data generated in the study at UMESC will be recorded in bound laboratory notebooks or kept in file folders (SOP No. GEN 008). All data sheets, file folders, laboratory notebooks and computer disks will be encoded with the study number when the data are generated and stored in secure files (SOP No. GEN 008). Raw data, laboratory notebooks and electronic files (including a CD-ROM containing the annotated SAS program used for the statistical analysis, the data files, SAS log and SAS output files) generated by UMESC and contract laboratory reports will be filed in the UMESC archives (SOP No. GEN 007) of the Upper Midwest Environmental Sciences Center, La Crosse Wisconsin, before the final report is signed by the Study Director. The final report will then be signed and archived.

10. GOOD LABORATORY PRACTICES

Data collection, storage and retrieval procedures for the study will be conducted in compliance with FDA regulations for Good Laboratory Practices (GLP; 21 CFR, Part 58). The study protocol and progress of the study will be reviewed at the start of the study and periodically throughout the study by the Quality Assurance Unit (QAU). The Study Director has the responsibility of ensuring that all procedures used in conjunction with the study conform with Good Laboratory Practices.

11. AMENDMENT/DEVIATIONS TO THE PROTOCOL

11.1 Protocol amendments: A signed copy of the Study Protocol will be retained on-site. Proposed amendments to the protocol shall be brought to the attention of UMESC Management. When the Study Director and Management agree verbally, the study can proceed with the change. As soon as possible, the Study Director will then prepare a written protocol amendment that is signed by the Study Director, Branch Chief, UMESC Center Director, and UMESC-QA. The UMESC statistician or UMESC Animal Care and Use Chair may also sign as needed. The amendment then becomes an official part of the protocol.

11.2 Protocol deviations: All deviations from this approved protocol will be documented and reviewed by the Study Director. The Study Director will make a judgment on the impact of the deviations. The Study Director will notify Management, UMESC-QA, as soon as possible, in writing, of any deviations to the protocol, including their impact on the study.

12. INVESTIGATIONAL TEST ARTICLE

12.1 Test Substance(s): MBI-401 FDP, *Pseudomonas fluorescens* (*Pf*-CL145A)

12.1.1 Chemical name: *Pseudomonas fluorescens* (*Pf*-CL145A)

12.1.2 Trade name: MBI-401 FDP

12.1.3 Active ingredients: *Pseudomonas fluorescens* (*Pf*-CL145A) is the sole active ingredient, 100% active by weight.

12.1.4 Source: Marrone Bio Innovations (MBI); Davis, CA

12.1.5 Lot number: Multiple lots are expected to be tested. Lot number(s) will be included in the test chemical log books and lab notebook, and study files.

12.1.6 Expiration date: 3 months from the date of manufacturer. An aliquot of each lot tested will be returned to the NYSM or MBI at the conclusion of exposures at UMESC for confirmatory post-test activity comparative zebra mussel bioassay tests (the standard testing protocol to assess *Pseudomonas fluorescens* [*Pf*-CL145A] formulation activity). Results of these confirmation bioassays will be used to validate the activity retention of the MBI-401 FDP, *Pseudomonas fluorescens* (*Pf*-CL145A) and will be included in the study files when available.

12.1.7 Storage during study: test chemical will be stored refrigerated in a locked container within a restrictive entry laboratory. A subsample of the test chemical will be archived in the UMESC Chemical Archive (UMESC SOP GEN 011).

12.1.8 A NIOSH approved respirator will be used when preparing stock solutions to avoid inhalation. Protective eyewear, gloves and lab coats will be worn at all times when working with the test substance.

13. ADVERSE EVENTS: Any adverse event will be recorded in the study logbook and the Study Director will be notified.

14. BIOSECURITY PROCEDURES

14.1 General Procedures: All personnel involved in the study will review the UMESC biosecurity (UMESC SOP APP 075) and project HACCP plans. Testing will be conducted in a laboratory with controlled access. All effluent water will be chlorine disinfected prior to discharge.

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Biosecurity procedures outlined in UMESC SOP APP 075.0 will be followed for samples and equipment.

14.2 HACCP Plan: See Appendix 1 for the HACCP plan for this project.

15. STANDARD OPERATING PROCEDURES

A complete list of the standard operating procedures used in the study will be included in the study guide. The follow SOP's were cited in this protocol:

UMESC SOP GEN 007 – Archives Management for Regulated Studies
UMESC SOP GEN 008 – Maintenance of Data Recording of Raw Data for Regulated Studies
UMESC SOP GEN 132 – Care, Maintenance & Disposal of Aquatic Vertebrates
UMESC SOP APP 075 – Procedures to Minimize the Risk of Transfer of Pathogens and Invasive Species
UMESC SOP AEH 011 – Procedures for Labeling Chemicals and Specimens
UMESC SOP AEH 188 – Accumet Portable Waterproof Conductivity meter Model # AP75
UMESC SOP AEH 301 – Instrument Operating Procedure: YSI Photometer Model # 9000 Serial # 3638017
UMESC SOP AEH 303 – Instrument Operating Procedure: Beckman spectrophotometer Model DU 800 Serial # 8003098
UMESC SOP AEH 308 – Instrument Operating Procedure: Milwaukee Light Meter Model # SM7000 Serial # 727298
UMESC SOP AEH 335 – Beckman Portable pH/mV Meter, Model 250
UMESC SOP AEH 338 – Sartorius Model BP 3100S, Serial Number 12907582
UMESC SOP AEH 394 – YSI Handheld Dissolved Oxygen Meter, Model 55/12FT, Serials 94C17261 & 97F0837AG
UMESC SOP AEH 706 – Determination of Total Alkalinity by the Titrimetric (pH 4.5) Method
UMESC SOP AEH 712 – Determination of Total Hardness

16. REFERENCES.

American Society for Testing and Materials, 2006. Standard guide for conducting laboratory toxicity tests with freshwater mussels. E2455-06. In Annual Book of ASTM Standards, Vol 11.06. Philidelphia, PA.

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17. APPENDIX.

17.1 Appendix 1. HACCP PLAN for the study Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Step 1 – Activity Description

Facility: US Geological Survey-Upper Midwest Environmental Sciences Center	Site: Lower B, rooms 15, 16 and 17
Site Coordinator: Jim Luoma	Activity: Determine the effects of various concentrations of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.
Site Manager: Mark Gaikowski	
Address: 2630 Fanta Reed Road La Crosse WI, 54601	
Phone: 608-781-6322	

Project Description
The objective of this study is to determine effects of various concentrations of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.

Step 2 – Potential Hazards: Species which may potentially be moved/introduced

Vertebrates: None
Invertebrates: Zebra mussel (*Dreissena polymorpha*)
Plants: None
Other biologicals (disease, pathogen, parasite): Largemouth Bass Virus Spring Viremia of Carp Virus Bluegill Virus Infectious Pancreatic Necrosis Virus Viral Hemorrhagic Septicemia Furunculosis *Aeromonas salmonicida* Enteric Redmouth Disease *Yersinia ruckeri* Bacterial Kidney Disease *Renibacterium salmoninarum* Other Assorted parasites/pathogens commonly found in the upper Mississippi River Basin
Other (construction materials): NA

Step 3 – Flow Diagram

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Flow diagram outlining sequential tasks to complete activity/project

Task 1	Juvenile mussels are obtained from the Genoa NFH and transferred to UMESC.
Task 2	Juvenile mussels are distributed to test chambers in the invasive species laboratory
Task 3	Water samples collected and analyzed for chemical parameters
Task 4	Juvenile mussels are removed for enumeration and growth observations

1 Tasks (from HACCP Step 3 - Flow Diagram)	2 Potential hazards identified in HACCP Step 2	3 Are any potential hazards probable? (yes/no)	4 Justify evaluation for column 3	5 What control measures can be applied to prevent undesirable results?	6 Is this task a critical control point? (yes/no)
Task 1 Juvenile mussels are obtained from the Genoa NFH and transferred to UMESC.	Vertebrates	No	Juvenile mussels will be transported in clean well water and there will not be vertebrates present	N/A	no
	Invertebrates	yes	Juvenile mussel will be collected from donor mussels collected from wild sources.	Assure donor mussels have been cleaned and rinsed with well water prior to use. Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	yes
	Plants	No	The donor mussels are cleaned upon collection and held in clean well water prior to use.	Any plant material will be removed from donor mussels and equipment before transporting Genoa NFH.	no
	Others	yes	The potential transfer of fish diseases from mussels grown on host fish is possible.	Genoa NFH uses certified disease free fish for mussel infestations. Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	yes
Task 2 Juvenile mussels are distributed to test chambers in the invasive species laboratory	Vertebrates	no	Risk eliminated in Task 1	N/A	no
	Invertebrates	no	Risk eliminated in Task 1	Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	no
	Plants	no	Risk eliminated in Task 1	N/A	no

ORIGINAL

	Others	yes	The potential transfer of fish diseases from mussels grown on host fish is possible.	Genoa NFH uses certified disease free fish for mussel infestations. Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	yes

Task 3 Water samples collected and analyzed for chemical parameters	Vertebrates	No	Risk eliminated in Task 1	N/A	no
	Invertebrates	No	Risk eliminated in Task 1	Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	no
	Plants	No	Risk eliminated in Task 1	N/A	no
	Others	yes	The potential transfer of fish diseases from mussels grown on host fish is possible.	Genoa NFH uses certified disease free fish for mussel infestations. Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	yes

Task 4 Juvenile mussels are removed for enumeration and growth observations	Vertebrates	No	Risk eliminated in Task 1	N/A	no
	Invertebrates	No	Risk eliminated in Task 1	Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	no
	Plants	No	Risk eliminated in Task 1	N/A	no

ORIGINAL

	Others	yes	The potential transfer of fish diseases from glochidia has never been documented.	Genoa NFH uses certified disease free fish for mussel infestations. Effluent water is treated and equipment will be disinfected. Equipment remains in the laboratory.	yes

HACCP Plan Form
(all CCP's or "yes's" from column 6 of HACCP Step 4 – Hazard Analysis Worksheet)

Critical Control Point (CCP)	Significant Hazard(s)	Limits for each Control Measure	Monitoring: What	Monitoring: How	Monitoring: Frequency	Monitoring: Who	Evaluation & Corrective Action(s) (if needed)	Supporting Documentation (if any)
Task 1 Invertebrates	Invertebrate transfer	Invertebrates cannot be transferred. Donor mussels must be cleaned and rinsed Effluent water must be captured and treated.	Macro/Microscopic invertebrates	Manually remove inverts Clean and rinse donor mussels effluent water disinfection	Daily inspections immediately upon animal or sample transfer	All Staff	Supervisor and staff are responsible for careful attention to detail-Disinfection of equipment	Records in log book
Tasks 1, 2, 3, 4 Other	Fish disease pathogen transfer	Pathogens must not be allow to establish in facility. Certified disease free fish must be used to transform mussels. Effluent water must be captured and treated.	Effluent water chlorine treatment levels	Monitor sodium hypochlorite supplies and check chlorine concentrations	Daily inspections of sodium hypochlorite levels; weekly chlorine concentration monitoring	Lab technicians	Supervisor and staff are responsible for careful attention to detail and performing immediate corrective action to restore chlorine discharge levels	Records in log books

Facility: Upper Midwest Environmental Sciences Center	**Activity:** Determine the effects of various concentrations of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.
Address: 2630 Fanta Reed Road, La Crosse, WI 54601	
Signature: HACCP Plan was followed.	**Date:**

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: January 23, 2012
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Note To File #1 to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamprphosed juvenile mussels from seven different unionid species".

This note is to document and clarify the collection of pH and temperature data collected for un-ionized ammonia calculations for the *O. olivaria* (dosed 12 July 2011) and *A. ligamentina* (dosed 14 July 2011) juvenile mussel exposures.

Samples of the stock solutions (50, 100, 200 and 300 mg/L active + 300 mg/L heat deactivated) used to dose the *O. olivaria* (dosed 12 July 2011) and *A. ligamentina* (dosed 14 July 2011) mussels were collected to analyze for un-ionized ammonia. At the time of sample collection, the pH and temperature of the stock solutions were recorded on the sample vial labels and not on a datasheet. It was realized on 9 August 2011 that the data were not recorded properly and the pH and temperature values were transcribed from the original sample vials to a Water Quality Form 2 data sheet. The exact instruments used to collect data were not recorded, however, it is assumed from other data sheets and instrument calibration logs that study coded instruments pH4 and THERM 5 were used to collect the pH and temperature values for *O. olivaria* and pH 3 and THERM 6 were used to collect pH and temperature values for *A. ligamentina*.

No adverse effects to the study are anticipated as the data needed were collected when required, have been documented in the study record and clarified as to procedure in this note to file. Additionally, all instruments used to collect the data are calibrated on a daily basis and calibration records are available for the dates that these data were collected.

[redacted]	23 JAN 12	[redacted]	23JAN12
Written by Kerry L. Weber, M.S. Principal Investigator, UMESC	Date	Approved by James A. Luoma, B.A. Study Director, UMESC	Date

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: January 23, 2012
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Note To File #2 to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamprphosed juvenile mussels from seven different unionid species".

This note is to document and clarify the use of two Water Quality Form 2's [Exposure Period Dissolved Oxygen, pH, Temperature (File Folder 10C)] datasheets for recording data on13 July 2011 for the *O. olivaria* (Hickorynut) juvenile mussel test.

Sections 5.2.1-5.2.3 of the study protocol requires that the dissolved oxygen, temperature and pH be measured and recorded twice during the exposure period. Prior to the end of the exposure period on 13 July 2011, pH and temperature were measured and recorded when the 24-h ammonia samples were collected. The data collector had lined out the dissolved oxygen column not realizing that this information was also required. Upon becoming aware that dissolved oxygen measurements were required, a second datasheet was used to record the dissolved oxygen levels and the pH and temperature columns were lined out on this data sheet. No explanation was given by the data collector on either datasheet as to what occurred or why the columns were lined out. A brief note was made on the datasheet containing the dissolved oxygen levels to see the first datasheet for pH and temperature. A more detailed explanation was written on the datasheets on 25 July 2011 to clarify the reasoning for the two datasheets.

No adverse effects to the study are anticipated as all the required data were measured and recorded.

[redacted]	23 JAN 12	[redacted]	23 JAN 12
Written by Kerry L. Weber, M.S. Principal Investigator, UMESC	Date	Approved by James A. Luoma, B.A. Study Director, UMESC	Date

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: June 3, 2011
To: The Record Study Number AEH-11PSEUDO-02

Subject: Amendment 1- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11PSEUDO-02 is proposed as detailed on page 2 of this amendment. Revised text is indicated **in bold**.

This amendment changes when the feed will be initiated to the exposure chambers to include feeding during the pre-exposure period. This change is being implemented maximize the feed available to the test animals and to reduce the potential stress on test animals due to lack of feed.

Reviewed by:

[redacted] 03 Jun 11
Mark P. Gaikowski, M.A. — Date
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

[redacted] 06 June 2011
Jane E. Rivera, B.A. — Date
Acting Quality Assurance Officer,
UMESC

[redacted] 6/3/11
Michael Jawson, Ph.D. — Date
Center Director, UMESC

Approved by:

[redacted] 6/6/11
James A. Luoma, B.A. — Date
Study Director, UMESC

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

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ORIGINAL

Current text:

5.1.6 Feeding: After the exposure period, the exposure chambers will receive a constant supply of well water containing approximately 2.25 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

Revised text (in bold):

5.1.6 Feeding: **Approximately 24-h prior to the distribution of test animals**, the exposure chambers will receive a constant supply of well water containing approximately 2.25 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008).

Approximately 2-h prior to dosing, feed will be withheld and the exposure chambers will be allowed to clear with incoming 20°C well water. Feeding will resume after the 24-h exposure period. A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: June 22, 2011
To: The Record Study Number AEH-11PSEUDO-02

Subject: Amendment 2- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11PSEUDO-02 is proposed as detailed on page 2 of this amendment. Revised text is indicated **in bold**.

This amendment expands the data collection of the water chemistry parameters at the conclusion of the exposure period to include the measurements of alkalinity and hardness from each exposure concentration.

The amendment is in response to unexpected observed variations in alkalinity and hardness measurements during the first species tested (*Lampsilis higginsii*) under this protocol. Additional alkalinity and hardness data have been collected on the first three species (*Lampsilis higginsii, Lampsilis cardium,* and *Ligumia recta*) exposed in the test system and will be collected during future exposures.

Reviewed by:

[redacted] 22 Jun 2011
Mark P. Gaikowski, M.A. — Date
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

[redacted] 23 June 2011
Jane E. Rivera, B.A. — Date
Acting Quality Assurance Officer,
UMESC

[redacted] 6/24/2011
Michael Jawson, Ph.D. — Date
Center Director, UMESC

Approved by:

[redacted] 6/24/11
James A. Luoma, B.A. — Date
Study Director, UMESC

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Item No. 3
Pg 1 of 2

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

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Current text:

5.2.4 Hardness: The hardness will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples from the control and high concentrations. Additionally, the hardness will be measured weekly throughout the holding period on one representative exposure chamber for each species (UMESC SOP AEH 712).

5.2.5 Alkalinity: The alkalinity will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples from the control and high concentrations. Additionally, the alkalinity will be measured weekly throughout the holding period on one representative exposure chamber for each species (UMESC SOP AEH 706).

Revised text (in bold):

5.2.4 Hardness: The hardness will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples from **each test concentration.** Additionally, the hardness will be measured weekly throughout the holding period on one representative exposure chamber for each species (UMESC SOP AEH 712).

5.2.5 Alkalinity: The alkalinity will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples from **each test concentration**. Additionally, the alkalinity will be measured weekly throughout the holding period on one representative exposure chamber for each species (UMESC SOP AEH 706).

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: June 22, 2011
To: The Record Study Number AEH-11PSEUDO-02

Subject: Amendment 3- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11PSEUDO-02 is proposed as detailed on page 2 of this amendment. Revised text is indicated **in bold**.

This amendment reduces the feeding rate of the mussels during the holding period. The amendment is in response to observed accumulation of settled algae within the headbox, distribution box and exposure chambers. This feeding rate is still slightly above the calculated rate successfully used by Meintertz (2008) to rear *Lampsilis cardium* and *Lampsilis siliquoidea* and therefore should provide ample nutrition for the mussels.

Reviewed by:

[redacted]
Mark P. Gaikowski, M.A.
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

22 Jun 2011
Date

[redacted]
Jane E. Rivera, B.A.
Acting Quality Assurance Officer,
UMESC

23 June 2011
Date

[redacted]
Michael Jawson, Ph.D.
Center Director, UMESC

6/24/2011
Date

Approved by:

[redacted]
James A. Luoma, B.A.
Study Director, UMESC

6/24/11
Date

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

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Current text:

5.1.6 Feeding: After the exposure period, the exposure chambers will receive a constant supply of well water containing approximately 2.25 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

Revised text (in bold):

5.1.6 Feeding: After the exposure period, the exposure chambers will receive a constant supply of well water containing approximately **2.0** mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

ORIGINAL

Date: July 07, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Amendment 4- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11-PSEUDO-02 is proposed as detailed on page 2 of this amendment. Revised text is indicated **in bold**.

This amendment changes the software used to capture, record and analyze the photomicrographs of mussels for study # AEH-11-PSEUDO-02 from Image Pro® Express software to Nikon Elements BR® software.

The change to Nikon Elements BR® software enhances photomicrograph quality, analysis capabilities, and allows for technical support.

Reviewed by:

[redacted] Ø7Jul11
Mark P. Gaikowski, M.A. — Date
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

[redacted] July 8, 2011
Jane E. Rivera, B.A. — Date
Acting Quality Assurance Officer,
UMESC

[redacted] 7/7/11
Michael Jawson, Ph.D. — Date
Center Director, UMESC

Approved by:

[redacted] 7/11/11
James A. Luoma, B.A. — Date
Study Director, UMESC

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

FF # 3
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Current text:

5.5.1 Survival and growth: Survival will be determined by observing foot movement, heart beat or ciliary movement. Growth will be determined by comparing valve length measurements from photomicrograph records captured and analyzed using Image Pro® Express software. Comparisons will be made between treatments as well as to mussel images recorded prior to the test initiation.

6.2 Determination of survival and growth: Survival of recovered mussels will be determined by observing foot movement, heart beat or ciliary movement. Growth will be determined by comparing valve length measurements from photomicrograph records captured and analyzed using Image Pro® Express software. Comparisons will be made between treatments as well as to mussel images recorded prior to the test initiation.

Revised text (in bold):

5.5.1 Survival and growth: Survival will be determined by observing foot movement, heart beat or ciliary movement. Growth will be determined by comparing valve length measurements from photomicrograph records captured and analyzed using **Nikon Elements BR® software.** Comparisons will be made between treatments as well as to mussel images recorded prior to the test initiation.

6.2 Determination of survival and growth: Survival of recovered mussels will be determined by observing foot movement, heart beat or ciliary movement. Growth will be determined by comparing valve length measurements from photomicrograph records captured and analyzed using **Nikon Elements BR® software**. Comparisons will be made between treatments as well as to mussel images recorded prior to the test initiation.

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U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: July 07, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Amendment 5- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11-PSEUDO-02 is proposed as detailed on page 2 of this amendment. Revised text is indicated **in bold**.

This amendment changes the sampling regime for ammonia due to observed results. Ammonia analysis will be increased to include sampling of individual exposure chambers during the exposure period. The individual exposure chamber samples will be filtered through a 0.45 micron filter, acidified using sulfuric acid and stored in a refrigerator until analysis by the UMESC Long Term Resources Monitoring Program (LTRMP) Water Quality Laboratory using the automated phenate method (APHA [American Public Health Association] 1992. Standard methods for the examination of water and wastewater. 18^{th} edition. American Public Health Association, Washington, D.C. Various pages). The LTRMP laboratory does not perform their analysis according to Good Laboratory Practices (GLP). Data Generated by LTRMP will be annotated to state it does not comply with GLP regulations in the final report.

These changes will provide information regarding the accumulation rate of ammonia within the exposure chambers.

Reviewed by:

[redacted]	07Jul11	[redacted]	Jul 8 2011
Mark P. Gaikowski, M.A. Supervisory Biologist Aquatic Ecosystem Health, UMESC[1]	Date	Jane E. Rivera, B.A. Acting Quality Assurance Officer, UMESC	Date
[redacted]	7/7/11		
Michael Jawson, Ph.D. Center Director, UMESC	Date		

Approved by:

[redacted] 7/11/11

James A. Luoma, B.A. Date
Study Director, UMESC

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Item No. 6
Pg 1 of 2

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

ORIGINAL

Current text:

5.2.7 Ammonia: The total ammonia will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples of each test concentration. Additionally, the ammonia will be measured weekly throughout the holding period on one representative exposure chamber (UMESC SOP AEH 301 or equivalent). Unionized ammonia will be calculated from the total ammonia, pH and temperature of the samples.

Revised text (in bold):

5.2.7 Ammonia: The total ammonia will be measured and recorded prior to test initiation **in untreated water collected from each distribution box**, upon exposure termination from pooled replicate water samples of each test concentration **collected from the center section of each exposure chamber**, and weekly throughout the holding period on one representative exposure chamber **water sample collected from the center section of each exposure chamber using a YSI 9000 spectrophotometer (UMESC SOP AEH 301 or equivalent). Additionally, 5 mL samples will be collected from the center section of each exposure vessel at 6, 12 and 24 h post exposure, filtered through a 0.45 µm syringe filter, acidified (pH ~2.5) with sulfuric acid and then stored at ~4°C until analysis by the UMESC-LTRMP water quality laboratory.**

Unionized ammonia will be calculated from the total ammonia, pH and temperature of the pooled samples **or from measurements recorded from the exposure chambers at the time of sampling.**

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: July 9, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Amendment 6 to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11-PSEUDO-02 is proposed as detailed on pages 2-5 of this amendment. Revised text is indicated ***In bold and underlined***.

This amendment for study # AEH-11-PSEUDO-02 alters the feeding regime, exposure chamber sediment use and post exposure holding period in response to observed low and variable survival of higgins eye (*L. higginsii*), plain pocket book (*L. cardium*) and black sandshell (*L. recta*) mussels assigned to the control groups in test initiated from June 6-8, 2011. Future studies will be conducted according to the procedures outlined in this amendment. If higgins eye, plain pocket book and black sandshell mussels are available then exposures may be repeated using the procedures described in this amendment.

Amendment 3 incorrectly referenced text (section 5.6.1) that had been revised by approval of Amendment 1. The current text for section 5.6.1 is given as intended from the approval of amendments 1 and 3. The revised text includes the changes made in amendments 1 and 3 with those changes proposed in this amendment in bold and underlined.

This amendment was discussed with the UMESC AEH supervisory biologist and the New York State Museum cooperating biologist and verbally approved, effective July 9, 2011.

Reviewed by:

[redacted] 18Jul2011
Mark P. Gaikowski, M.A. — Date
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

[redacted] 18Jul2011
Jane E. Rivera, B.A. — Date
Acting Quality Assurance Officer,
UMESC

[redacted] 7/18/2011
Michael Jawson, Ph.D. — Date
Center Director, UMESC

Approved by:

[redacted] 19JuL11
James A. Luoma, B.A. — Date
Study Director, UMESC

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Pg 1 of 5

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

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Current text:

4.1 General Description:

Newly metamorphosed juvenile mussels from 7 unionid mussel species (Table 2) endemic in the Great Lakes and Mississippi River basins will be evaluated for effects from exposure to varying concentrations of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]). Juvenile mussels will be placed into a flow through test apparatus and then exposed to the test material for 24 h in a static exposure. Following the exposure period, the water flow will resume to the exposure chambers and the mussels will be reared for an additional 30 days before being removed from the system and evaluated for survival and growth. The mussels will be preserved for possible histological examination. If histological examination is deemed necessary, a protocol amendment will be prepared to describe the methods and procedures to be used.

4.2 Experimental Design:

Donor mussel collection, host fish inoculation, and newly metamorphosed mussels harvesting will be performed at the Genoa NFH by USFWS biologists. Gravid donor mussels will be collected from the Upper Iowa, Upper Mississippi or St. Croix Rivers. Mussels will be identified to species as described in Cummings and Mayer (1992) and Watters et al. (2009) by staff at the Genoa NFH. Approximately 1,200 juvenile mussels from each species will be collected from the mussel propagation aquaria by Genoa NFH biologists and transferred to the UMESC at ~20°C. After acclimation to UMESC test water, the mussels will be placed in petri dishes and viewed under a dissecting microscope. Twenty mussels displaying active foot movement will be transferred with a disposable pipet into a 50-mL beaker or petri dish containing 20°C well water. The beaker or petri dish will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water and approximately 4 mm of 75 – 150 µm silica sand as substrate. The process will then be repeated until all exposure chambers receive a total of two distribution aliquots for a total of 40 juveniles for each exposure chamber. Additionally, two randomly chosen groups of 20 mussels of each species will be preserved to determine the initial mussel valve length.

Exposures will be initiated 12-24 h after the exposure chambers receive test animals by interrupting the fresh water flow and then adding the appropriate freshly prepared solution of MBI-401 FDP in a completely randomized design. There will be a total of four replicates for each exposure concentration, for a total of 24 exposure chambers per species (Figure 1). The exposure chambers will be held at 20°C on an 18:6 h light/dark cycle for the exposure and post exposure period. The exposure will be a single, dose of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) administered as a 24 h static exposure. Water flow will be resumed to the exposure chambers after the treatment period.

At 30-d post exposure, the contents of each exposure chamber will be sieved through a 200-µm screen to separate the juvenile mussels from the substrate. The mussels will be examined through a dissecting scope to determine viability and for enumeration. A photomicrograph of all surviving mussels will be

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recorded for each exposure chamber for growth measurements. The mussels will be euthanized and fixed in modified Davidson's solution for up to 48 h and then transferred to 70% ethanol.

5.1.6 Feeding: Approximately 24-h prior to the distribution of test animals, the exposure chambers will receive a constant supply of well water containing approximately 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008).
Approximately 2-h prior to dosing, feed will be withheld and the exposure chambers will be allowed to clear with incoming 20°C well water. Feeding will resume after the 24-h exposure period. A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

5.4.1.5 Exposure chamber dimensions: The exposure chambers are (17.8 x 5.1 x 8.3 mm) glass aquaria. Each exposure chamber will contain approximately 380 mL of well water and 35g of substrate.

6.1 Distribution to experimental units: Twenty mussels displaying active foot movement will be transferred with a disposable pipet to a 50 mL beaker containing 20°C well water. The beaker will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water with approximately 4 mm of 75 – 150 µm silica sand as substrate. This procedure will then be repeated until all chambers receive 40 mussels in two aliquots. The exposure chambers will be randomly assigned treatment concentration.

Revised text (in bold):
4.1 General Description:
Newly metamorphosed juvenile mussels from 7 unionid mussel species (Table 2) endemic in the Great Lakes and Mississippi River basins will be evaluated for effects from exposure to varying concentrations of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]). Juvenile mussels will be placed into a flow through test apparatus and then exposed to the test material for 24 h in a static exposure. Following the exposure period, the water flow will resume to the exposure chambers and the mussels will be reared for an additional ***7 days*** before being removed from the system and evaluated for survival and growth. The mussels will be preserved for possible histological examination. If histological examination is deemed necessary, a protocol amendment will be prepared to describe the methods and procedures to be used.

4.2 Experimental Design:
Donor mussel collection, host fish inoculation, and newly metamorphosed mussels harvesting will be performed at the Genoa NFH by USFWS biologists. Gravid donor mussels will be collected from the Upper Iowa, Upper Mississippi or

ORIGINAL

St. Croix Rivers. Mussels will be identified to species as described in Cummings and Mayer (1992) and Watters et al. (2009) by staff at the Genoa NFH. Approximately 1,200 juvenile mussels from each species will be collected from the mussel propagation aquaria by Genoa NFH biologists and transferred to the UMESC at ~20°C. After acclimation to UMESC test water, the mussels will be placed in petri dishes and viewed under a dissecting microscope. Twenty mussels displaying active foot movement will be transferred with a disposable pipet into a 50-mL beaker or petri dish containing 20°C well water. ***The beaker or petri dish will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water.*** The process will then be repeated until all exposure chambers receive a total of two distribution aliquots for a total of 40 juveniles for each exposure chamber. Additionally, two randomly chosen groups of 20 mussels of each species will be preserved to determine the initial mussel valve length.

Exposures will be initiated 12-24 h after the exposure chambers receive test animals by interrupting the fresh water flow and then adding the appropriate freshly prepared solution of MBI-401 FDP in a completely randomized design. There will be a total of four replicates for each exposure concentration, for a total of 24 exposure chambers per species (Figure 1). The exposure chambers will be held at 20°C on an 18:6 h light/dark cycle for the exposure and post exposure period. The exposure will be a single, dose of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) administered as a 24 h static exposure. Water flow will be resumed to the exposure chambers after the treatment period.

At 7 days post exposure, the contents of each exposure chamber will be sieved through a 150 or 200-µm screen to separate the juvenile mussels. The mussels will be examined through a dissecting scope to determine viability and for enumeration. A photomicrograph of all surviving mussels will be recorded for each exposure chamber for growth measurements. The mussels will be euthanized and fixed in modified Davidson's solution for up to 48 h and then transferred to 70% ethanol.

5.1.6 Feeding: Approximately ***2 h prior to the distribution of test animals feeding of the exposure chambers will commence by introduction of a*** constant supply of well water containing approximately 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008).

Approximately 2-h prior to dosing, feed will be withheld and the exposure chambers will be allowed to clear with incoming 20°C well water. Feeding will resume after the 24-h exposure period. A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox.

5.4.1.5 Exposure chamber dimensions: The exposure chambers are (17.8 x 5.1 x 8.3 mm) glass aquaria. ***Each exposure chamber will contain approximately 380 mL of well water.***

ORIGINAL

6.1 Distribution to experimental units: Twenty mussels displaying active foot movement will be transferred with a disposable pipet to a 50 mL beaker containing 20°C well water. ***The beaker will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water.*** This procedure will then be repeated until all chambers receive 40 mussels in two aliquots. ***A treatment concentration will be randomly assigned to each exposure chamber according to a predetermined randomization scheme.***

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: December 08, 2011

To: The Record Study Number AEH-11-PSEUDO-02

Subject: Amendment 7- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11-PSEUDO-02 is proposed as detailed on page 2 of this amendment. Revised text is indicated **in bold**.

This amendment deletes using the YSI 9000 spectrophotometer ammonia sampling method and analyzing pooled replicate samples. All ammonia samples will be filtered through a 0.45 micron filter, acidified using sulfuric acid and stored in a refrigerator until analysis by the UMESC Long Term Resources Monitoring Program (LTRMP) Water Quality Laboratory using the automated phenate method (APHA [American Public Health Association] 1992. Standard methods for the examination of water and wastewater. 18th edition. American Public Health Association, Washington, D.C. Various pages). The LTRMP laboratory does not perform their analysis according to Good Laboratory Practices (GLP). Data Generated by LTRMP will be annotated to state it does not comply with GLP regulations in the final report.

Reviewed by:

[redacted]
Mark P. Gaikowski, M.A.
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

8 Dec 11
Date

[redacted]
Jane E. Rivera, B.A.
Acting Quality Assurance Officer,
UMESC

9 December 2011
Date

[redacted]
Michael Jawson, Ph.D.
Center Director, UMESC

12/12/11
Date

Approved by:

[redacted]
James A. Luoma, B.A.
Study Director, UMESC

12/13/2011
Date

FF # 3
Item No. 8
Pg 1 of 2

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

Current text:

5.2.7 Ammonia: The total ammonia will be measured and recorded prior to test initiation in untreated water collected from each distribution box, upon exposure termination from pooled replicate water samples of each test concentration collected from the center section of each exposure chamber, and weekly throughout the holding period on one representative exposure chamber water sample collected from the center section of each exposure chamber using a YSI 9000 spectrophotometer (UMESC SOP AEH 301 or equivalent). Additionally, 5 mL samples will be collected from the center section of each exposure vessel at 6, 12 and 24 h post exposure, filtered through a 0.45 µm syringe filter, acidified (pH ~2.5) with sulfuric acid and then stored at ~4°C until analysis by the UMESC-LTRMP water quality laboratory.

Unionized ammonia will be calculated from the total ammonia, pH and temperature of the pooled samples or from measurements recorded from the exposure chambers at the time of sampling.

Revised text (in bold):

5.2.7 Ammonia: The total ammonia will be measured and recorded prior to test initiation in untreated water collected from each distribution box, **upon exposure termination from water samples collected from the center section of each exposure vessel at 6, 12 and 24 h post exposure, and prior to test termination in untreated water collected from each distribution box. 5 mL samples will be removed at each sampling time and at least 3 mL of each sample will filtered through a 0.45 µm syringe filter, acidified (pH ~2.5) with sulfuric acid and then stored at ~4°C until analysis by the UMESC-LTRMP water quality laboratory.**

Unionized ammonia will be calculated using the UMESC-LTRMP total ammonia data and the pH and temperature measurements recorded from the exposure chambers or distribution boxes at the time of sampling.

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Item No. 8
Pg 2 of 2

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: December 20, 2011

To: The Record Study Number AEH-11-PSEUDO-02

Subject: Amendment 8- Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11-PSEUDO-02 is proposed as detailed on pages 2-7 of this amendment. Revised text is indicated **in bold.**

This amendment changes the test material from a Freeze dried (FDP) to a spray dried (SDP) formulation.

The initially manufacturer-preferred freeze dried formulation (FDP) of *Pseudomonas fluorescens* has recently been discontinued and the manufacturer has indicated support for a spray-dried (SDP) formulation.
The exposures will be conducted in an identical fashion except for the change in product formulation. Mussel species previously exposed to FDP will not be re-evaluated with the SDP formulation; data collected during FDP exposures will be retained in the study data management system.

Reviewed by:

[redacted] 20Dec2011
Mark P. Gaikowski, M.A. — Date
Supervisory Biologist
Aquatic Ecosystem Health,
UMESC[1]

[redacted] 12/22/2011
Michael Jawson, Ph.D. — Date
Center Director, UMESC

Approved by:

[redacted] 12/22/11
James A. Luoma, B.A. — Date
Study Director, UMESC

FF # 3
Item No. 9
Pg 1 of 7

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

Current text:

1. INTRODUCTION: (paragraph 5 of Section 1 is the only paragraph affected by this amendment)

Biologists at the New York State Museum (NYSM) Field Research Laboratory have been researching dreissenid mussel control since 1991 and they discovered that a bacterium isolated from soils (*Pseudomonas fluorescens* [Pf-CL145A]) is efficacious for controlling zebra mussels. Marrone Bio Innovations (MBI; Davis, CA) is currently developing a freeze dried formulation of this bacterium called MBI-401 FDP. The current commercial applications of this product are for use with closed systems such as power generating plant cooling systems. The NYSM has partnered with the USFWS (Genoa NFH) and United States Geological Survey's (USGS) Upper Midwest Environmental Sciences Center (UMESC) to determine the suitability of this product for open water zebra mussel control applications such as treatment of native mussel propagation cages or native mussel beds.

2. PROTOCOL OBJECTIVE:

This study will determine the animal effects of various concentrations of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) to the newly metamorphosed lifestage of seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.

4. STUDY DESIGN:

4.1 General Description:

Newly metamorphosed juvenile mussels from 7 unionid mussel species (Table 2) endemic in the Great Lakes and Mississippi River basins will be evaluated for effects from exposure to varying concentrations of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]). Juvenile mussels will be placed into a flow through test apparatus and then exposed to the test material for 24 h in a static exposure. Following the exposure period, the water flow will resume to the exposure chambers and the mussels will be reared for an additional 7 days before being removed from the system and evaluated for survival and growth. The mussels will be preserved for possible histological examination. If histological examination is deemed necessary, a protocol amendment will be prepared to describe the methods and procedures to be used.

4.2 Experimental Design:

Donor mussel collection, host fish inoculation, and newly metamorphosed mussels harvesting will be performed at the Genoa NFH by USFWS biologists. Gravid donor mussels will be collected from the Upper Iowa, Upper Mississippi or St. Croix Rivers. Mussels will be identified to species as described in Cummings and Mayer (1992) and Watters et al. (2009) by staff at the Genoa NFH.

Approximately 1,200 juvenile mussels from each species will be collected from the mussel propagation aquaria by Genoa NFH biologists and transferred to the UMESC at ~20°C. After acclimation to UMESC test water, the mussels will be placed in petri dishes and viewed under a dissecting microscope. Twenty mussels displaying active foot movement will be transferred with a disposable pipet into a 50-mL beaker or petri dish containing 20°C well water. The beaker or petri dish will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water. The process will then be repeated until all exposure chambers receive a total of two distribution aliquots for a total of 40 juveniles for each exposure chamber. Additionally, two randomly chosen groups of 20 mussels of each species will be preserved to determine the initial mussel valve length.

Exposures will be initiated 12-24 h after the exposure chambers receive test animals by interrupting the fresh water flow and then adding the appropriate freshly prepared solution of MBI-401 FDP in a completely randomized design. There will be a total of four replicates for each exposure concentration, for a total of 24 exposure chambers per species (Figure 1). The exposure chambers will be held at 20°C on an 18:6 h light/dark cycle for the exposure and post exposure period. The exposure will be a single, dose of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) administered as a 24 h static exposure. Water flow will be resumed to the exposure chambers after the treatment period.

At 7 days post exposure, the contents of each exposure chamber will be sieved through a 150 or 200-µm screen to separate the juvenile mussels. The mussels will be examined through a dissecting scope to determine viability and for enumeration. A photomicrograph of all surviving mussels will be recorded for each exposure chamber for growth measurements. The mussels will be euthanized and fixed in modified Davidson's solution for up to 48 h and then transferred to 70% ethanol.

5. STUDY PROCEDURES

5.6 Treatment administration:

5.6.1 Treatment: Each species of mussels will be exposed to four replicates of either 0 (control), 50, 100, 200 or 300 mg/L and a 300 mg/L heat deactivated (70°C/45 minutes) control as a single dose exposure.

5.6.2 Route of administration: Exposures will be initiated by addition of an appropriate freshly prepared solution of MBI-401 FDP in a completely randomized design. The test concentrations will include 0 (control), 300 mg/L deactivated (positive control), or 50, 100, 200, or 300 mg/L of active MBI-401 FDP. To assure proper concentration levels, the exposure chamber water volume will be lowered as far as possible and the chamber will be flushed with the treatment solution before refilling to the original volume.

5.6.3 Dose verification: The activity of MBI-401 FDP (*Pseudomonas fluorescens* [*Pf*-CL145A]) cannot be assessed by current analytical techniques as the chemical nature of the active agent in the bacterium has not been determined or characterized. Dosage verification of MBI-401 FDP will be assessed by measuring and recording the absorbance of the prepared stock dosing solution and the high treatment concentrations with a Beckman DU 800 UV/Vis spectrophotometer (UMESC SOP AEH 303). The collected absorbance information will be used to determine inter- and intra-test variability in the preparation of stock and test solutions.

12. INVESTIGATIONAL TEST ARTICLE

12.1 Test Substance(s): MBI-401 FDP, *Pseudomonas fluorescens* (*Pf*-CL145A)

12.1.1 Chemical name: *Pseudomonas fluorescens* (*Pf*-CL145A)

12.1.2 Trade name: MBI-401 FDP

12.1.3 Active ingredients: *Pseudomonas fluorescens* (*Pf*-CL145A) is the sole active ingredient, 100% active by weight.

12.1.4 Source: Marrone Bio Innovations (MBI); Davis, CA

12.1.5 Lot number: Multiple lots are expected to be tested. Lot number(s) will be included in the test chemical log books and lab notebook, and study files.

12.1.6 Expiration date: 3 months from the date of manufacturer. An aliquot of each lot tested will be returned to the NYSM or MBI at the conclusion of exposures at UMESC for confirmatory post-test activity comparative zebra mussel bioassay tests (the standard testing protocol to assess *Pseudomonas fluorescens* [*Pf*-CL145A] formulation activity). Results of these confirmation bioassays will be used to validate the activity retention of the MBI-401 FDP, *Pseudomonas fluorescens* (*Pf*-CL145A) and will be included in the study files when available.

12.1.7 Storage during study: test chemical will be stored refrigerated in a locked container within a restrictive entry laboratory. A subsample of the test chemical will be archived in the UMESC Chemical Archive (UMESC SOP GEN 011).

12.1.8 A NIOSH approved respirator will be used when preparing stock solutions to avoid inhalation. Protective eyewear, gloves and lab coats will be worn at all times when working with the test substance.

Revised text:

1. INTRODUCTION: (paragraph 5 of Section 1 is the only paragraph affected by this amendment)

Biologists at the New York State Museum (NYSM) Field Research Laboratory have been researching dreissenid mussel control since 1991 and they discovered that a bacterium isolated from soils (*Pseudomonas fluorescens* [Pf-CL145A]) is efficacious for controlling zebra mussels. Marrone Bio Innovations (MBI; Davis, CA) is currently developing a **spray** dried formulation of this bacterium called MBI-401 **SDP**. The current commercial applications of this product are for use with closed systems such as power generating plant cooling systems. The NYSM has partnered with the USFWS (Genoa NFH) and United States Geological Survey's (USGS) Upper Midwest Environmental Sciences Center (UMESC) to determine the suitability of this product for open water zebra mussel control applications such as treatment of native mussel propagation cages or native mussel beds.

2. PROTOCOL OBJECTIVE:

This study will determine the animal effects of various concentrations of MBI-401 **SDP** (*Pseudomonas fluorescens* [*Pf*-CL145A]) to the newly metamorphosed lifestage of seven unionid mussels species present in the Great Lakes and Upper Mississippi River basins.

4. STUDY DESIGN:

4.1 General Description:

Newly metamorphosed juvenile mussels from 7 unionid mussel species (Table 2) endemic in the Great Lakes and Mississippi River basins will be evaluated for effects from exposure to varying concentrations of MBI-401 **SDP** (*Pseudomonas fluorescens* [*Pf*-CL145A]). Juvenile mussels will be placed into a flow through test apparatus and then exposed to the test material for 24 h in a static exposure. Following the exposure period, the water flow will resume to the exposure chambers and the mussels will be reared for an additional 7 days before being removed from the system and evaluated for survival and growth. The mussels will be preserved for possible histological examination. If histological examination is deemed necessary, a protocol amendment will be prepared to describe the methods and procedures to be used.

4.2 Experimental Design:

Donor mussel collection, host fish inoculation, and newly metamorphosed mussels harvesting will be performed at the Genoa NFH by USFWS biologists. Gravid donor mussels will be collected from the Upper Iowa, Upper Mississippi or St. Croix Rivers. Mussels will be identified to species as described in Cummings and Mayer (1992) and Watters et al. (2009) by staff at the Genoa NFH. Approximately 1,200 juvenile mussels from each species will be collected from the mussel propagation aquaria by Genoa NFH biologists and transferred to the UMESC at ~20°C. After acclimation to UMESC test water, the mussels will be placed in petri dishes and viewed under a dissecting microscope. Twenty mussels displaying active foot movement will be transferred with a disposable pipet into a 50-mL beaker or petri dish containing 20°C well water. The beaker or petri dish will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water. The process will then be repeated until all exposure chambers receive a total of two distribution aliquots for a total of 40 juveniles for each exposure chamber. Additionally, two randomly chosen groups of 20 mussels of each species will be preserved to determine the initial mussel valve length.

Exposures will be initiated 12-24 h after the exposure chambers receive test animals by interrupting the fresh water flow and then adding the appropriate freshly prepared solution of MBI-401 **SDP** in a completely randomized design. There will be a total of four replicates for each exposure concentration, for a total of 24 exposure chambers per species (Figure 1). The exposure chambers will be held at 20°C on an 18:6 h light/dark cycle for the exposure and post exposure period. The exposure will be a single, dose of MBI-401 **SDP** (*Pseudomonas fluorescens* [*Pf*-CL145A]) administered as a 24 h static exposure. Water flow will be resumed to the exposure chambers after the treatment period.

At 7 days post exposure, the contents of each exposure chamber will be sieved through a 150 or 200-µm screen to separate the juvenile mussels. The mussels will be examined through a dissecting scope to determine viability and for enumeration. A photomicrograph of all surviving mussels will be recorded for each exposure chamber for growth measurements. The mussels will be euthanized and fixed in modified Davidson's solution for up to 48 h and then transferred to 70% ethanol.

5. STUDY PROCEDURES

5.6 Treatment administration:

5.6.1 Treatment: Each species of mussels will be exposed to four replicates of either 0 (control), 50, 100, 200 or 300 mg/L and a 300 mg/L heat deactivated (70°C/45 minutes) control as a single dose exposure.

5.6.2 Route of administration: Exposures will be initiated by addition of an appropriate freshly prepared solution of MBI-401 **SDP** in a completely randomized design. The test concentrations will include 0 (control), 300 mg/L deactivated (positive control), or 50, 100, 200, or 300 mg/L of active MBI-401 **SDP**. To assure proper concentration levels, the exposure chamber water volume will be lowered as far as possible and the chamber will be flushed with the treatment solution before refilling to the original volume.

5.6.3 Dose verification: The activity of MBI-401 **SDP** (*Pseudomonas fluorescens* [*Pf*-CL145A]) cannot be assessed by current analytical techniques as the chemical nature of the active agent in the bacterium has not been determined or characterized. Dosage verification of MBI-401 **SDP** will be assessed by measuring and recording the absorbance of the prepared stock dosing solution and the high treatment concentrations with a Beckman DU 800 UV/Vis spectrophotometer (UMESC SOP AEH 303). The collected absorbance information will be used to determine inter- and intra-test variability in the preparation of stock and test solutions.

12. INVESTIGATIONAL TEST ARTICLE

12.1 Test Substance(s): MBI-401 **SDP**, *Pseudomonas fluorescens* (*Pf*-CL145A)

12.1.1 Chemical name: *Pseudomonas fluorescens* (*Pf*-CL145A)

12.1.2 Trade name: MBI-401 **SDP**

12.1.3 Active ingredients: *Pseudomonas fluorescens* (*Pf*-CL145A) is the sole active ingredient, **50%** active by weight.

12.1.4 Source: Marrone Bio Innovations (MBI); Davis, CA

12.1.5 Lot number: Multiple lots are expected to be tested. Lot number(s) will be included in the test chemical log books and lab notebook, and study files.

12.1.6 Expiration date: **Expiration date is not known, therefore,** an aliquot of each lot tested will be returned to the NYSM or MBI at the conclusion of exposures at UMESC for confirmatory post-test activity comparative zebra mussel bioassay tests (the standard testing protocol to assess *Pseudomonas fluorescens* [*Pf*-CL145A] formulation activity). Results of these confirmation bioassays will be used to validate the activity retention of the MBI-401 **SDP**, *Pseudomonas fluorescens* (*Pf*-CL145A) and will be included in the study files when available.

12.1.7 Storage during study: test chemical will be stored refrigerated in a locked container within a restrictive entry laboratory. A subsample of the test chemical will be archived in the UMESC Chemical Archive (UMESC SOP GEN 011).

12.1.8 A NIOSH approved respirator will be used when preparing stock solutions to avoid inhalation. Protective eyewear, gloves and lab coats will be worn at all times when working with the test substance.

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Item No. 9
Pg 7 of 7

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

Date: May 12, 2014
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Amendment 9 - Amendment to the study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Revision of Study Protocol, Study # AEH-11-PSEUDO-02 as detailed on page 2 of this amendment. Revised text is in **bold and underlined**, deleted text has a ~~strike through~~.

This amendment documents the change of status of study number AEH-11-PSEUDO-02 titled "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" from a Good Laboratory Practices (GLP) regulated study to a non-GLP regulated study. The data resulting from this study will not be used to support a product registration, therefore, a verbal decision with UMESC management was agreed to on April 22, 2014 to change the status of the study to non-regulated.

Reviewed by:

[redacted] 13May2014
Mark P. Gaikowski, M.A. — Date
Supervisory Biologist
Aquatic Ecosystem Health, UMESC[1]

[redacted] 5/13/2014
Jane E. Rivera, B.A. — Date
Acting Quality Assurance Officer, UMESC

[redacted] 05/14/2014
for Kevin D. Richards, Ph.D. — Date
Acting Center Director, UMESC

Approved by:

[redacted] 15MAY2014
James A. Luoma, B.A. — Date
Study Director, UMESC

FF # 3
Item No. 10
Pg 1 **of** 2

[1] UMESC: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

Current text:

10. GOOD LABORATORY PRACTICES

Data collection, storage and retrieval procedures for the study will be conducted in compliance with FDA regulations for Good Laboratory Practices (GLP; 21 CFR, Part 58). The study protocol and progress of the study will be reviewed at the start of the study and periodically throughout the study by the Quality Assurance Unit (QAU). The Study Director has the responsibility of ensuring that all procedures used in conjunction with the study conform with Good Laboratory Practices.

Revised text (<u>in bold and underlined</u>):

10. GOOD LABORATORY PRACTICES

Data collection, storage and retrieval procedures for the study will be **<u>not be</u>** conducted in compliance with FDA regulations for Good Laboratory Practices (GLP; 21 CFR, Part 58). The study protocol and progress of the study **<u>may</u>** ~~will~~ be reviewed at the start of the study and periodically throughout the study by the Quality Assurance Unit (QAU). The Study Director has the responsibility of ensuring that all procedures used in conjunction with the study **<u>conforms to</u>** ~~with~~ Good Scientific ~~Laboratory~~ Practices.

FF # 3
Item No. 10
Pg 2 of 2

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder:______ Lab book/pgs:______ Reviewed:_______ Verified:________

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species:____

Collection Date(s) :____

Collection Location:____________________ **Container ID:**______________________

Approximate Number of Mussels:__________________

Mussel collected and identified by:____________________ **Affiliation**______________

Dosing Date: ______________ **Formulation and lot #** ___________________________

Additional information:

____

____

____

____

____

UMESC MUSSEL LOT NUMBER DESIGNATION:_________________________

Witness and form recorded by:

Printed Name	Signature	Affiliation	Date
		UMESC	

FF # 19
Item No. 1
Pg 1 of 1

This datasheet was approved by [redacted] on 18JAN2012
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder:______ Lab book/pgs:______ Reviewed:______ Verified:________

Newly Metamorphosed Juvenile Mussel Distribution Form

Species:________________________________ **UMESC LOT NUMBER:**____________

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution____________

Initial Distribution Aliquot date/time (military):________________________________

Final Distribution Aliquot date/time (military):________________________________

Number of Aliquot rounds:__________ **Number of mussels/chamber**________________

Additional information:

____

____

____

____

____

____

____

Witness and form recorded by:

Printed Name	Signature	Affiliation	Date
		UMESC	

FF # 19
Item No. 2
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder:______ Lab book/pgs:______ Reviewed:_______ Verified:________

Newly Metamorphosed Mussel Exposure Dosing Form

Species:________________________________ **UMESC lot number:**____________

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation:________________________________

Date/time (military) of dosing completion:________________________________

Chemical Lot :______________**Stock Chemical Sample I.D.**______________________

Test Solution Preparation Time:____________________

Test Solution preparation description (include dilution volume):

____

____

____

Additional information:

____

____

Witness and form recorded by:

		UMESC	
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 19
Item No. 3
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder:_____ Lab book/pgs:_____ Reviewed:______ Verified:_______

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot #___________Date Rec'd___________ Exp. Date___________

Mussel Species _________________ System 1 2 3

Instruments ____

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared prior to use to allow for deactivation and cooling.

This datasheet was approved by [redacted] on 18JAN2012.
11JAN2012/version1.1

FF # 19
Item No. 4
Pg 1 of 1

Study Number AEH-11-PSEUDO-02
Reviewed: ____________
Verified: ____________

File Folder: ____________
Lab book/pgs: ____________
Species: ____________
System: ____________
Date of Dosing: ____________
Formulation and lot #: ____________

Chemical Stock Solution Determination and Preparation

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 50% active ingredient[20mg/mL]) *** Make 10g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [20mg/mL]***Make 10g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use
Dilution water = 20°C UMESC Well Water

Dose Level (mg/L)	Final Solution Volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Dilution water to add to container (mL)	*Well Water* Aliquot Stock A (mL)	*Active Stock* Aliquot Stock B (mL)	*Deactive Stock* Aliquot Stock C (mL)	Color Code Assignment
0	5,000	0	0	0	0	5000.0	0.0	0.0	White
300 HD	5,000	1,500	1500	0	4,850	0.0	0.0	150.0	White/black stripes
50	5,000	250	0	250	4,975	0.0	25.0	0.0	Yellow
100	5,000	500	0	500	4,950	0.0	50.0	0.0	Yellow/black stripes
200	5,000	1,000	0	1000	4,900	0.0	100.0	0.0	Blue
300 Active	5,000	1,500	0	1500	4,850	0.0	150.0	0.0	Blue/black stripes
Total						5000.0	5000.0	325.0	150.0

Concentration (mg/L)	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Initials	Date
0							
300 HD							
50							
100							
200							
300 Active							

FF # 19
Item No. 5
Pg 1 of 1

This datasheet was approved b[redacted] on 19 Jan 2012.
11JAN2012/version1.2

Study Number AEH-11-PSEUDO-02

File Folder: ______ Lab book/pgs: ______ Reviewed: ______ Verified: ______

Water Quality – Form 1
Pre-Exposure

Mussel Species: ______ **System:** ______

Dosing Date: ______ **Formulation and lot #:** ______

Instruments: ______

Dissolved Oxygen, Temperature, pH, Hardness, Alkalinity, and Conductivity								
Dissolved Oxygen (mg/L)	Temperature (°C)	pH	Conductivity (µS/cm)	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Date	Time (military)	Initials

Total and Un-ionized Ammonia Data				
Temperature (°C)	pH	Date	Time (military)	Initials

Note: Measure and record the temperature and pH for the total and un-ionized ammonia when the sample to be analyzed by LTRMP is taken.

FF # 19
Item No. 6
Pg 1 of 1

This datasheet was approved by [redacted] on 12JAN2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

File Folder: ___________ Lab book/pgs: _________ , Reviewed: ___________ Verified: __________

Water Quality Form 2

Exposure Period Dissolved Oxygen, pH, Temperature

Mussel Species: ____________________ **System ID:** ____

Dosing Date: ______________________ **Formulation and lot #:** ______________________________

Instruments: _______________________

Chamber ID	Dissolved Oxygen (mg/L)	pH	Temperature (°C)	Date	Time (military)	Initials

Note: Dissolved oxygen, pH, and temperature will be measured at least twice during the exposure period in every exposure chamber.

FF # 19
Item No. 9
Pg 1 of 1

FF # ~~____~~
Item No. ____
NL
[illegible]

This datasheet was approved by: [redacted] ____________ on 11 JAN 2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

File Folder: __________ Lab book/pgs: __________ Reviewed: __________ Verified: __________

Water Quality Form 2a

Exposure Period pH and Temperature for Ammonia Analysis

Mussel Species: ________________ **System ID:** ____

Dosing Date: ________________ **Formulation and lot #:** ________________

Instruments: ________________

Chamber ID	Time Period Post-exposure	pH	Temperature (°C)	Date	Time (military)	Initials

Note: Ammonia samples will be collected at 6, 12 and 24-hour post-exposure from each exposure chamber. The samples will be filtered through a 0.45 µm syringe filter. 3 mL of the filtered sample will be acidified by 60 µL of 10% sulfuric acid. Temperature and pH will be measured when the ammonia samples are collected.

FF # 19
Item No. 8
Pg 1 of 1

This datasheet was approved by: [redacted] on 19JAN2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________ Verified: ________

FF # 19
Item No. 9
Pg 1 of 1

Water Quality – Form 3

Exposure Termination Hardness, Alkalinity and Conductivity

Instruments: ________

System ID: ________ **Mussel Species:** ________

Dosing Date: ________ **Formulation and lot #:** ________

Hardness and Alkalinity

Pooled Concentration	Chamber IDs	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Date	Time (military)	Initials
Control (0 mg/L)						
50 mg/ L Active						
100 mg/ L Active						
200 mg/L Active						
300 mg/L Active						
300 mg/L Deactivated						

Conductivity

Pooled Concentration	Chamber IDs	Conductivity (µS/cm)	Date	Time (military)	Initials
Control (0 mg/L)					
50 mg/ L Active					
100 mg/ L Active					
200 mg/L Active					
300 mg/L Active					
300 mg/L Deactivated					

This datasheet was approved by: [redacted] on 11Jan2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

FF # 19
Item No. 10
Pg 1 of 1

File Folder: ____________ Lab book/pgs: ____________ Reviewed: ____________ Verified: ____________

Daily Water Quality – Form 4 Dissolved Oxygen, pH, and Temperature

Mussel Species: ____________ **System ID:** ___ **Instruments:** ____________ **Month:** ____________
Dosing Date: ____________ **Formulation and lot #:** ____________

Day	Days Post Exposure	Block A Chamber ID	Dissolved Oxygen (mg/L)	pH	Temperature (°C)	Block B Chamber ID	Dissolved Oxygen (mg/L)	pH	Temperature (°C)	Date	Time (military)	Initials
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
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18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Note: Water quality parameters will be measured in two chambers per system daily (one chamber in block A and one chamber in block B, chosen at random).

Version 1.1/11JAN2012 This datasheet was approved by [redacted] ____________ on 11 JAN 2012.

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________ Verified: ________

Weekly Water Quality – Form 5 Hardness, Alkalinity and Conductivity

Mussel Species: ________ **System:** ________

Dosing Date: ________ **Formulation and lot #:** ________

Instruments: ________

Chamber ID	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Conductivity (µS/cm)	Date	Time (military)	Initials

Note: Weekly water quality parameters will be measured from one chamber randomly selected from each system. For parameters requiring a water sample to be collected for analysis (hardness and alkalinity), water will be collected from the outflow section of each sampled exposure chambers.

FF # 19
Item No. 11
Pg 1 of 1

Chamber ID	pH	Temperature (°C)	Date	Time (military)	Initials

Note: Measure and record the temperature and pH for the total and un-ionized ammonia when the sample to be analyzed by LTRMP is taken.

This datasheet was approved by: [redacted] on 12 JAN 2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________ Verified: ________

System Conditions – Form 1 Light Intensity

Sample Period (circle one); During Exposure/Weekly

Mussel Species: ____________ **System ID:** ________

Dosing Date: ________ **Formulation and lot #:** ____________

Instruments: ____________

Block ID	Light Intensity (lux)	Date	Time (military)	Initials
A				
B				
A				
B				
System Mean				

Note: During exposure light intensity will be measured upon initiation and prior to termination of exposure period in both blocks of each system. Weekly light intensity will be measured twice during the week in both blocks of each system.

FF # 19
Item No. 12
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________ Verified: ________

System Condition - Form 3 Daily Flow Rates (mL/minute)

Mussel Species: ________ System ID: ____ Block: ____ Dosing Date: ________ Chemical lot #: ________ Month: ________

Day	Day Post Exposure	1	2	3	4	5	6	7	8	9	10	11	12	Date	Time (military)	Initials
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
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FF # 19
Item No. 13
Pg 1 of 1

NOTE: Flow rates should be measured daily from four chambers in each block, resulting in each chamber being measured every three days. On the days that a chamber's flow rate is not measured, that chamber's flow rate should be visually observed for flow rate. Mark these observations as "VO" for visual observation. Chambers that are visually observed and appear to have a slow flow rate are measured for flow rate and values are to be recorded in the first column for the chamber rather than being marked with VO.

NOTE: First column for chamber is original flow rate; If original flow rate is below 7.0 mL/min, then a second flow rate is taken and recorded in second column for chamber. A (1) after original flow rate denotes that the syringe tip was cleaned. A (2) after original flow rate denotes that the syringe tip was replaced.

Version 1.2/11JAN2012 This datasheet was approved by [redacted] on 11 JAN 2012.

Study Number AEH-11-PSEUDO-02

FF # 19
Item No. 14
Pg 1 of 1

File Folder: ____ Lab book/pgs: ____ Reviewed: ____ Verified: ____

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: ____ **Batch #:** ____ **Expiration Date:** ____

Feeding Chart: ____ **Species:** ____ **System:** ____

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: ____/____/____

24 h Dry Weight: ____/____/____

48 h Dry Weight: ____/____/____

Balance: ____ **Weight Set(s):** ____ **Drying Oven / Temperature(°C):** ____

Mean Percent Dry Weight [Sum of column I, divided by 6]: ____

Version 1.1/11JAN2012 This datasheet was approved by [redacted] on 12 JAN 2012.

Study Number AEH-11-PSEUDO-02

File Folder: __________ Lab book/pgs: __________ Reviewed: __________ Verified: __________

Algae Stock Solution Preparation

Species: ______________________ System: ______________

Dosing Date: ____________ Formulation and lot #: ____________________

Instruments: ____

Day	Days Post Exposure	Food Delivery Rate (mL/min)	Headbox Flow Rate (mL/min)	Chlorella (g)	Nanno (g)	Tetra (g)	Date	Time (military)	Initials
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
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23									
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26									
27									
28									
29									
30									
31									

FF # 19
Item No. 15
Pg 1 of 1

Note: Food delivery rate is 2.0 mL/minute (±0.1). Headbox flow rate is 320 mL/minute (± 20). If flow rates deviate adjust accordingly.

Note: Use Algae Stock Preparation Chart (File folder 13a) and headbox flow rate from this form to determine wet weight of each algal diet for stock preparation. Mix algal diets with well water for a total volu[redacted]and place on stir plate.

11JAN2012/version 1.1 This datasheet was approved by [redacted] on 19 JAN 2012.

Study Number AEH-11-PSEUDO-02

FF # 19
Item No. 16
Pg 1 of 1

File Folder: ______ Lab book/pgs: ______ Reviewed: ______ Verified: ______

Algae Stock Solution Dry Weight Determination

Mussel Species: ______ System: ______

Feeding Chart: ______ Dosing Date: ______

A	B	C	D	E	F	G	H
Pan ID	Pan Tare Weight (mg)	Sample Stock Volume (mL)	24 h Pan + Sample Dry Weight (mg)	48 h Pan + Sample Dry Weight (mg)	Pan + Sample Mean Dry Weight (mg) [(D+E)/2]	Sample Mean Dry Weight (mg) [F-B]	Sample Concentration (mg/mL) [G/C]
						Mean	
Well Water Sample							
						Mean	

Initials/Date/Time (military): To be filled out at each respective time point.

Sample Collection: ____/____/____

Pan Tare Weight: ____/____/____

24 h Dry Weight: ____/____/____

48 h Dry Weight: ____/____/____

Mean sample concentration (mg/L) without salt content from well water (Difference between means in column H)

Balance: ______ **Weight Set(s):** ______ **Drying Oven / Temperature(°C):** ______

Version 1.2/11JAN2012 This datasheet was approved by [redacted] ______ on 11 JAN 2012.

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________________ Verified: ________________

FF # 19
Item No. 17
Pg 1 of 1

Juvenile Mussel Recovery Datasheet

Dosing Date: ____________________ **Formulation and lot #:** ________________________________

System Number	Species	Chamber ID	Number of Mussels Recovered	Number of Viable Mussels	Comments	Date	Initials

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________________ Verified: ____________

Dosing Date: ____________________ Formulation and lot #: ________________________________

Juvenile Mussel Micropictograph Datasheet

System Number	Species	Chamber ID	Micropictograph ID	Date	Initials

FF # [illegible]

This datasheet was approved by [redacted] on 11 JAN 2012.

Item No. 18

11JAN2012/version 1.1

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Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Reviewed: ________________ Verified: ________________

Dosing Date: ______________ Formulation and lot #: ______________________________

FF # 19
Item No. 19
Pg 1 of 1

Juvenile Mussel Measurement Datasheet

System Number	Species	Chamber ID	Micropictograph ID	Mussel ID	Length (µm)	Date	Initials

This datasheet was approved by [redacted] on 11 JAN 2012.

Version 1.1/11JAN2012

Study Number AEH-11-PSEUDO-02

File Folder: ___________ Lab book/pgs: ___________ Reviewed: ___________ Verified: ___________

Pipette Calibration

Pipette Brand/Model/SN: ______________________ **Tip Type:** ______________

Balance: ______________________ **Thermometer:** ______________________

Temperature: ______________ **Water Density[1] (g/mL):** ______________________

Pipette Setting (µL)	Rep #	Water Mass (g)	Date	Time (military)	Initials
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	Mean				
	Standard Deviation				

Relative Standard Deviation (Standard Deviation / Mean *100): ______________________

Pass or Fail (Pass = Relative Standard Deviation ≤ 1%): ______________________

Pipette Volume (Mean mass / Water Density[1]): ______________________

Note: Pipette calibration must be performed with deionized water left to adjust to ambient room temperature for at least 24 hours prior to calibration.

[1] Water density (g/mL) at varying temperatures: 18°C: 0.9985976; 19°C: 0.9984073; 20°C: 0.9982063; 21°C: 0.9979948; 22°C:0.9977730.

FF # 19
Item No. 20
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version 1.1

Study Number AEH-11-PSEUDO-02

File Folder: ____________ Lab book/pgs: ____________ Proofed: ____________ Reviewed: ____________

Exposure Chamber Substrate Weight and Distribution Datasheet

Balance: ______________________ **Weight Set(s):** ______________________

Beaker ID	Sand Weight (g) [35g ± 0.1g]	Date	Initials	Distributed to: Chamber ID	Date	Initials

These data forms were revised on Jan 11-18①, 2012 and will no longer be used.
KLW
18JAN2012

①wrote wrong date. Shoul[redacted] be Jan 11-18 2012. Klw 18JAN2012

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 23MAY 2011

FF # 19
Item No. 21
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Pg 1 of 32

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted]________ Date 31 MAY 2011

File Folder:____[redacted]ab book/pgs:______ Proofed:______ Reviewed:________

Newly Metamorphosed Juvenile Mussel Distribution Form

Species:________________________________ **UMESC LOT NUMBER:**___________

Test Block Assignment (circle one):__1____2____3____

Estimated # Mussels/Distribution____________

Initial Distribution Aliquot date/time (military):________________________________

Final Distribution Aliquot date/time (military):________________________________

Number of Aliquot rounds:_________ **Number of mussels/chamber**_______________

Additional information:

____

____

____

____

____

____

____

Witness and form recorded by:

		UMESC	
Printed Name	**Signature**	**Affiliation**	**Date**

Pg 2 **of** 32

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted]__________ Date 31 MAY 2011

File Folder: [redacted] Lab book/pgs:_____ Proofed:_____ Reviewed:_____

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species:______________________________

Collection Date(s) :______________________________

Collection Location:______________ **Container ID:**______________

Approximate Number of Mussels:______________

Mussel collected and identified by:______________ **Genoa NFH**__________

Additional information:

____

____

____

UMESC MUSSEL LOT NUMBER DESIGNATION:______________

Witness and form recorded by:

		UMESC	
Printed Name	**Signature**	**Affiliation**	**Date**

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Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: ________ **Batch #:** ________ **Expiration Date:** ________

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: ______/______/______

24 h Dry Weight: ______/______/______

48 h Dry Weight: ______/______/______

Balance: ________ **Weight Set(s):** ________ **Drying Oven / Temperature(°C):** ________

Mean Percent Dry Weight [Sum of column I, divided by 6]: ________

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/3/11

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Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Algae Stock Solution Dry Weight Determination

A	B	C	D	E	F	G	H
Pan ID	Pan Tare Weight (mg)	Sample Stock Volume (mL)	24 h Pan + Sample Dry Weight (mg)	48 h Pan + Sample Dry Weight (mg)	Pan + Sample Mean Dry Weight (mg) [(D+E)/2]	Sample Mean Dry Weight (mg) [F-B]	Sample Concentration (mg/mL) [G/C]
Mussel Species: ________				**System: 1**			
Mussel Species: ________				**System: 2**			
Mussel Species: ________				**System: 3**			
Well Water Sample							

Initials/Date/Time (military): To be filled out at each respective time point.

Sample Collection: ____/____/____

Pan Tare Weight: ____/____/____

24 h Dry Weight: ____/____/____

48 h Dry Weight: ____/____/____

Balance: ________ **Weight Set(s):** ________ **Drying Oven / Temperature(°C):** ________

Mean Sample Concentrations [Average of three reps in column H] **(mg/mL):**

Algae System 1: ________ **Algae System 2:** ________ **Algae System 3:** ________ **Water:** ________

Version 1.1 / 22JUN2011 Approved by: [redacted] Date: 6/2-/11

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Algae Stock Solution Dry Weight Determination

Mussel Species: ________				**System: 1**			
A	B	C	D	E	F	G	H
Pan ID	Pan Tare Weight (mg)	Algae Stock Volume (mL)	24 h Pan + Diet Dry Weight (mg)	48 h Pan + Diet Dry Weight (mg)	Pan + Algae Mean Dry Weight (mg) [(D+E)/2]	Algae Mean Dry Weight (mg) [F-B]	Algae Concentration (mg/mL) [G/C]
Mussel Species: ________				**System: 2**			
Mussel Species: ________				**System: 3**			

Initials/Date/Time (military): To be filled out at each respective time point.

Sample Collection: ____/____/____

Pan Tare Weight: ____/____/____

24 h Dry Weight: ____/____/____

48 h Dry Weight: ____/____/____

Balance: ________ **Weight Set(s):** ________ **Drying Oven / Temperature(°C):** ________

Mean Algae Concentrations [Average of three reps in column H] **(mg/mL):**

System 1: ________ **System 2:** ________ **System 3:** ________

Version 1.0 / 01JUN2011 Approved by [redacted] Date: 6/2/11

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Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Algae Stock Solution Preparation

Month: ________

Day	Days Post Exposure	System 1 Mussel Species: ________				System 2 Mussel Species: ________				System 3 Mussel Species: ________				Date	Time (military)	Initials
		Headbox Flow Rate (mL/min)	Chlorella (g)	Nanno (g)	Tetra (g)	Headbox Flow Rate (mL/min)	Chlorella (g)	Nanno (g)	Tetra (g)	Headbox Flow Rate (mL/min)	Chlorella (g)	Nanno (g)	Tetra (g)			
1																
2																
3																
4																
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Note: Use Algae Stock Preparation Chart (File folder 13a) and headbox flow rate from SC Form 2 (File folder 18b) to determine wet weight of each algal diet for stock preparation. Mix algal diets with 3,600 mL well water and place on stir plate.

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

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Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 6/27/11

Algae Stock Preparation Chart

Version 1.2 Effective Date 6/27/11 Initials Sn

Chlorella Dry wt	**2.58 %**
Nanno Dry wt	**19.82 %**
Tetra Dry wt	**17.34 %**
Delivery pump setting	**2.0 mL/min**

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	14.05	1.83	2.09
301	541.8	2.0	3.6	545.4	363.6	14.09	1.83	2.10
302	543.6	2.0	3.6	547.2	364.8	14.14	1.84	2.10
303	545.4	2.0	3.6	549.0	366.0	14.19	1.85	2.11
304	547.2	2.0	3.6	550.8	367.2	14.23	1.85	2.12
305	549.0	2.0	3.6	552.6	368.4	14.28	1.86	2.12
306	550.8	2.0	3.6	554.4	369.6	14.33	1.86	2.13
307	552.6	2.0	3.6	556.2	370.8	14.37	1.87	2.14
308	554.4	2.0	3.6	558.0	372.0	14.42	1.88	2.15
309	556.2	2.0	3.6	559.8	373.2	14.47	1.88	2.15
310	558.0	2.0	3.6	561.6	374.4	14.51	1.89	2.16
311	559.8	2.0	3.6	563.4	375.6	14.56	1.90	2.17
312	561.6	2.0	3.6	565.2	376.8	14.60	1.90	2.17
313	563.4	2.0	3.6	567.0	378.0	14.65	1.91	2.18
314	565.2	2.0	3.6	568.8	379.2	14.70	1.91	2.19
315	567.0	2.0	3.6	570.6	380.4	14.74	1.92	2.19
316	568.8	2.0	3.6	572.4	381.6	14.79	1.93	2.20
317	570.6	2.0	3.6	574.2	382.8	14.84	1.93	2.21
318	572.4	2.0	3.6	576.0	384.0	14.88	1.94	2.21
319	574.2	2.0	3.6	577.8	385.2	14.93	1.94	2.22
320	576.0	2.0	3.6	579.6	386.4	14.98	1.95	2.23
321	577.8	2.0	3.6	581.4	387.6	15.02	1.96	2.24
322	579.6	2.0	3.6	583.2	388.8	15.07	1.96	2.24

Pg 8 **of** 32

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 6/7/11

Algae Stock Preparation Chart

Version 1.0 Effective Date 6/7/11 Initials JN

Chlorella Dry wt	**2.17 %**
Nanno Dry wt	**19.82 %**
Tetra Dry wt	**17.34 %**
Delivery pump setting	**2.0 mL/min**

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	407.7	18.79	2.06	2.35
301	541.8	2.0	3.6	545.4	409.1	18.85	2.06	2.36
302	543.6	2.0	3.6	547.2	410.4	18.91	2.07	2.37
303	545.4	2.0	3.6	549.0	411.8	18.97	2.08	2.37
304	547.2	2.0	3.6	550.8	413.1	19.04	2.08	2.38
305	549.0	2.0	3.6	552.6	414.5	19.10	2.09	2.39
306	550.8	2.0	3.6	554.4	415.8	19.16	2.10	2.40
307	552.6	2.0	3.6	556.2	417.2	19.22	2.10	2.41
308	554.4	2.0	3.6	558.0	418.5	19.29	2.11	2.41
309	556.2	2.0	3.6	559.8	419.9	19.35	2.12	2.42
310	558.0	2.0	3.6	561.6	421.2	19.41	2.13	2.43
311	559.8	2.0	3.6	563.4	422.6	19.47	2.13	2.44
312	561.6	2.0	3.6	565.2	423.9	19.53	2.14	2.44
313	563.4	2.0	3.6	567.0	425.3	19.60	2.15	2.45
314	565.2	2.0	3.6	568.8	426.6	19.66	2.15	2.46
315	567.0	2.0	3.6	570.6	428.0	19.72	2.16	2.47
316	568.8	2.0	3.6	572.4	429.3	19.78	2.17	2.48
317	570.6	2.0	3.6	574.2	430.7	19.85	2.17	2.48
318	572.4	2.0	3.6	576.0	432.0	19.91	2.18	2.49
319	574.2	2.0	3.6	577.8	433.4	19.97	2.19	2.50
320	576.0	2.0	3.6	579.6	434.7	20.03	2.19	2.51
321	577.8	2.0	3.6	581.4	436.1	20.09	2.20	2.51
322	579.6	2.0	3.6	583.2	437.4	20.16	2.21	2.52

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Approved[redacted]_____________ **Date** 6/6/11

Algae Stock Preparation Chart

Version 1.1 Effective Date 6/6/11 Initials Jw

Chlorella Dry wt 2.9 %
Nanno Dry wt 19.82 %
Tetra Dry wt 17.34 %
Delivery pump setting 2.0 mL/min

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	407.7	14.06	2.06	2.35
301	541.8	2.0	3.6	545.4	409.1	14.11	2.06	2.36
302	543.6	2.0	3.6	547.2	410.4	14.15	2.07	2.37
303	545.4	2.0	3.6	549.0	411.8	14.20	2.08	2.37
304	547.2	2.0	3.6	550.8	413.1	14.24	2.08	2.38
305	549.0	2.0	3.6	552.6	414.5	14.29	2.09	2.39
306	550.8	2.0	3.6	554.4	415.8	14.34	2.10	2.40
307	552.6	2.0	3.6	556.2	417.2	14.38	2.10	2.41
308	554.4	2.0	3.6	558.0	418.5	14.43	2.11	2.41
309	556.2	2.0	3.6	559.8	419.9	14.48	2.12	2.42
310	558.0	2.0	3.6	561.6	421.2	14.52	2.13	2.43
311	559.8	2.0	3.6	563.4	422.6	14.57	2.13	2.44
312	561.6	2.0	3.6	565.2	423.9	14.62	2.14	2.44
313	563.4	2.0	3.6	567.0	425.3	14.66	2.15	2.45
314	565.2	2.0	3.6	568.8	426.6	14.71	2.15	2.46
315	567.0	2.0	3.6	570.6	428.0	14.76	2.16	2.47
316	568.8	2.0	3.6	572.4	429.3	14.80	2.17	2.48
317	570.6	2.0	3.6	574.2	430.7	14.85	2.17	2.48
318	572.4	2.0	3.6	576.0	432.0	14.90	2.18	2.49
319	574.2	2.0	3.6	577.8	433.4	14.94	2.19	2.50
320	576.0	2.0	3.6	579.6	434.7	14.99	2.19	2.51
321	577.8	2.0	3.6	581.4	436.1	15.04	2.20	2.51
322	579.6	2.0	3.6	583.2	437.4	15.08	2.21	2.52

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 7/7/11

Algae Stock Preparation Chart

Version 1.3 Effective Date 7/7/2011 Initials KLW

Chlorella Dry wt	**1.81 %**
Nanno Dry wt	**19.82 %**
Tetra Dry wt	**17.34 %**
Delivery pump setting	**2.0 mL/min**

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	20.02	1.83	2.09
301	541.8	2.0	3.6	545.4	363.6	20.09	1.83	2.10
302	543.6	2.0	3.6	547.2	364.8	20.15	1.84	2.10
303	545.4	2.0	3.6	549.0	366.0	20.22	1.85	2.11
304	547.2	2.0	3.6	550.8	367.2	20.29	1.85	2.12
305	549.0	2.0	3.6	552.6	368.4	20.35	1.86	2.12
306	550.8	2.0	3.6	554.4	369.6	20.42	1.86	2.13
307	552.6	2.0	3.6	556.2	370.8	20.49	1.87	2.14
308	554.4	2.0	3.6	558.0	372.0	20.55	1.88	2.15
309	556.2	2.0	3.6	559.8	373.2	20.62	1.88	2.15
310	558.0	2.0	3.6	561.6	374.4	20.69	1.89	2.16
311	559.8	2.0	3.6	563.4	375.6	20.75	1.90	2.17
312	561.6	2.0	3.6	565.2	376.8	20.82	1.90	2.17
313	563.4	2.0	3.6	567.0	378.0	20.88	1.91	2.18
314	565.2	2.0	3.6	568.8	379.2	20.95	1.91	2.19
315	567.0	2.0	3.6	570.6	380.4	21.02	1.92	2.19
316	568.8	2.0	3.6	572.4	381.6	21.08	1.93	2.20
317	570.6	2.0	3.6	574.2	382.8	21.15	1.93	2.21
318	572.4	2.0	3.6	576.0	384.0	21.22	1.94	2.21
319	574.2	2.0	3.6	577.8	385.2	21.28	1.94	2.22
320	576.0	2.0	3.6	579.6	386.4	21.35	1.95	2.23
321	577.8	2.0	3.6	581.4	387.6	21.41	1.96	2.24
322	579.6	2.0	3.6	583.2	388.8	21.48	1.96	2.24

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 5/21/11

File Folder: [redacted] Lab book/pgs:_____ Proofed:_____ Reviewed:_____

Newly Metamorphosed Mussel Exposure Dosing Form

Species:____________________ **UMESC lot number:**__________

Test System Assignment (circle one):__1____2____3___

Number mussel/Chamber__40__ Number of replicate Chambers/Concentration ___4___

Number of Concentrations (including control)__6__

Date/time (military) of dosing initiation:____________________

Date/time (military) of dosing completion:____________________

Chemical Lot :____________**Stock Chemical Sample I.D.**____________

Test Solution Preparation Time:____________

Test Solution preparation description (include dilution volume):

____

____

____

Additional information:

____

____

Witness and form recorded by:

		UMESC	
Printed Name	**Signature**	**Affiliation**	**Date**

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Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted]______________ Date 31 MAY 2011

File Folder:______ Lab book/pgs:______ Proofed:_______ Reviewed:________

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot #_________ Date Rec'd_____________ Exp. Date____________

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared at least 1 hr prior to use to allow for deactivation and cooling.

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Study Number AE[redacted]

Approved by: ______________ **Date** 6/24/11

File Folder:

Version: 1.1/24JUNE2011

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Chemical Stock Solution Determination

Stock A = **Control** (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)

Stock B = 10,000 mg/L; 100% active ingredient[10mg/mL]) *** Make 5g/500 mL well water per each test system

Stock C = 10,000 mg/L detoxified active material [10mg/mL]***Make 5g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use

Dosage Level (mg/L)	Dose concentration	Test solution Stock volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Aliquot Stock A (mL)	Aliquot Stock B (mL)	Aliquot Stock C (mL)	Color Code Assignment
0	control (well water blank)	5,000	0	0	0	0.0	0.0	0.0	White
300	mg/L (Deactivated)	5,000	1,500	1500	0	0.0	0.0	150.0	White/black stripes
50	mg/L	5,000	250	0	250	0.0	25.0	0.0	Yellow
100	mg/l	5,000	500	0	500	0.0	50.0	0.0	Yellow/black stripes
200	mg/L	5,000	1,000	0	1000	0.0	100.0	0.0	Blue
300	mg/L	5,000	1,500	0	1500	0.0	150.0	0.0	Blue/black stripes
Total						0.0	325.0	150.0	

Concentration	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Intiails	Date
0 mg/L							
300 mg/L Deactive							
50 mg/L							
100 mg/L							
200 mg/L							
300 mg/L Active							

Study Number AEH-11-PSEUDO-0[redacted]

Approved by: [redacted] Date 6/6/11

Chemical Stock Solution Determination

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 100% active ingredient[10mg/mL]) *** Make 5g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [10mg/mL]***Make 5g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use

Dosage Level (mg/L)	Dose concentration	Test solution Stock volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Aliquot Stock A (mL)	Aliquot Stock B (mL)	Aliquot Stock C (mL)	Color Code Assignment
0	control (well water blank)	5,000	0	0	0	0.0	0.0	0.0	White
300	mg/L (Deactivated)	5,000	1,500	1500	0	0.0	0.0	150.0	White/black stripes
50	mg/L	5,000	250	0	250	0.0	25.0	0.0	Yellow
100	mg/L	5,000	500	0	500	0.0	50.0	0.0	Yellow/black stripes
200	mg/L	5,000	1,000	0	1000	0.0	100.0	0.0	Blue
300	mg/L	5,000	1,500	0	1500	0.0	150.0	0.0	Blue/black stripes
Total						0.0	325.0	150.0	

Study Number AEH-11-PSEUDO-02

File Folder: __________ Lab book/pgs: __________ Proofed: __________ Reviewed: __________

Water Quality – Form 1a

Pre-Exposure Dissolved Oxygen, Temperature, pH, Hardness, Alkalinity, and Conductivity

System 1 Mussel Species: __________

System 2 Mussel Species: __________

System 3 Mussel Species: __________ **Instruments:** __________

Mussel Species: __________ **Sample Location:** __________

System #	Dissolved Oxygen (mg/L)	Temperature (°C)	pH	Conductivity (µS/cm)	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Date	Time (military)	Initials
1									
2									
3									

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

File Folder: ________________ Lab book/pgs: ________________ Proofed: ________________ Reviewed: ________________

Water Quality – Form 1b

Pre-Exposure Total and Un-ionized Ammonia

System 1 Mussel Species: ________________________________

System 2 Mussel Species: ________________________________

System 3 Mussel Species: ________________________________ **Instruments:** ________________________________

System ID	pH	Temperature (°C)	Percent Transmittance (%T)	Total Ammonia[1] Nitrogen (mg/L)	Calculated Un-ionized Ammonia[1] (mg/L)	Date	Time (military)	Initials
1								
2								
3								

Note: Parameters to calculate un-ionized ammonia will be measured from samples from each systems distribution box.
[1] Follow procedures in SOP AEH 301.0 to calculate total ammonia nitrogen from %T and to calculate un-ionized ammonia from temperature, pH, and total ammonia nitrogen.

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Water Quality – Form 3a

Exposure Termination Total and Un-ionized Ammonia

Mussel Species: ________ **System ID:** ______ **Instruments:** ________

Pooled Concentration	Chamber IDs	pH	Temperature (°C)	Percent Transmittance (%T)	Total Ammonia Nitrogen[1] (mg/L)	Calculated Un-ionized Ammonia[1] (mg/L)	Date	Time (military)	Initials
Control (0 mg/L)									
50 mg/ L Active									
100 mg/ L Active									
200 mg/L Active									
300 mg/L Active									
300 mg/L Deactivated									

Note: Parameters to calculate un-ionized ammonia will be measured from pooled replicate samples from each test concentration upon exposure termination.
[1] Follow procedures in SOP AEH 301.0 to calculate total ammonia nitrogen from %T and to calculate un-ionized ammonia from temperature, pH, and total ammonia nitrogen.

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Water Quality – Form 3b

Exposure Termination Hardness, Alkalinity and Conductivity

Instruments: ________________

System ID: ________ **Mussel Species:** ________________

Hardness and Alkalinity

Pooled Concentration	Chamber IDs	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Date	Time (military)	Initials
Control (0 mg/L)						
300 mg/L Active						

Conductivity

Pooled Concentration	Chamber IDs	Conductivity (µS/cm)	Date	Time (military)	Initials
Control (0 mg/L)					
50 mg/ L Active					
100 mg/ L Active					
200 mg/L Active					
300 mg/L Active					
300 mg/L Deactivated					

Version 1.0 / 01JUN2011 Approved by [redacted] Date: 6/2/11

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

Total and Un-ionized Ammonia Accumulation

Instruments: ________ **Concentration:** ________

Sample Filtered or Un-filtered: ________ **Start Time (Time 0):** ________

Chamber ID	Chamber Sampling Location	Sampling Hour	pH	Temperature (°C)	Percent Transmittance (%T)	Total Ammonia[1] Nitrogen (mg/L)	Calculated Un-ionized Ammonia[1] (mg/L)	Date	Time (military)	Initials

1 Follow procedures in SOP AEH 301.0 to calculate total ammonia nitrogen from %T and to calculate un-ionized ammonia from temperature, pH, and total ammonia nitrogen.

Version 1.0 / 21JUN2011 Approved by [redacted] ________ Date: 6/2./11

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: ________ Proofed: ________ Reviewed: ________

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Daily Water Quality – Form 4 Dissolved Oxygen, pH, and Temperature

Mussel Species: ________ **System ID:** ____ **Instruments:** ________ **Month:** ________

Day	Days Post Exposure	Block A Chamber ID	Dissolved Oxygen (mg/L)	pH	Temperature (°C)	Block B Chamber ID	Dissolved Oxygen (mg/L)	pH	Temperature (°C)	Date	Time (military)	Initials
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Note: Water quality parameters will be measured in two chambers per system daily (one chamber in block A and one chamber in block B, chosen at random).

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

Study Number AEH-11-PSEUDO-02

File Folder: __________ Lab book/pgs: __________ Proofed: __________ Reviewed: __________

System Conditions – Form 1 Light Intensity

Sample Period (circle one); During Exposure/Weekly

Instruments: ______________________________

Mussel Species: ______________________ **System ID:** 1

Block ID	Light Intensity (lux)	Date	Time (military)	Initials
A				
B				
A				
B				
System 1 Mean				

Mussel Species: ______________________ **System ID:** 2

Block ID	Light Intensity (lux)	Date	Time (military)	Initials
A				
B				
A				
B				
System 2 Mean				

Mussel Species: ______________________ **System ID:** 3

Block ID	Light Intensity (lux)	Date	Time (military)	Initials
A				
B				
A				
B				
System 3 Mean				

Note: During exposure light intensity will be measured upon initiation and prior to termination of exposure period in both blocks of each system. Weekly light intensity will be measured twice during the week in both blocks of each system.

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

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Study Number AEH-11-PSEUDO-02

File Folder: ______ Lab book/pgs: ______ Proofed: ______ Reviewed: ______

System Conditions – Form 2 Daily Food Stock and Headbox Flow Rates

Month: ______

Day	Days Post Exposure	System 1 Mussel Species: ______		System 2 Mussel Species: ______		System 3 Mussel Species: ______		Date	Time (military)	Initials
		Food Delivery Rate (mL/min)	Headbox Flow Rate (mL/min)	Food Delivery Rate (mL/min)	Headbox Flow Rate (mL/min)	Food Delivery Rate (mL/min)	Headbox Flow Rate (mL/min)			
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										

Note: Target food delivery rate is to be kept relatively constant at 2.0 mL/minute (±0.1). Headbox flow rate target is 320 mL/minute (±20). If headbox flow rate approaches upper or lower limit, adjust flow accordingly.

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

Study Number AEH-11-PSEUDO-02

File Folder: ____________ Lab book/pgs: ____________ Proofed: ____________ Reviewed: ____________

Pg 24 of 32

System Condition - Form 3 Daily Flow Rates (mL/minute)

Mussel Species: ____________ System ID: ____________ Block: ____________ Month: ____________

Day	Day Post Exposure	1		2		3		4		5		6		7		8		9		10		11		12		Date	Time (military)	Initials
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												
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26																												
27																												
28																												
29																												
30																												
31																												

NOTE: Flow rates should be measured daily from four chambers in each block, resulting in each chamber being measured every three days. On the days that a chamber's flow rate is not measured, that chamber's flow rate should be visually observed for flow rate. Mark these observations as "VO" for visual observation. Chambers that are visually observed and appear to have a slow flow rate are measured for flow rate and values are to be recorded in the first column for the chamber rather than being marked with VO.

NOTE: First column for chamber is original flow rate; If original flow rate is below 7.0 mL/min, then a second flow rate is taken and recorded in second column for chamber. A (1) after original flow rate denotes that the syringe tip was cleaned. A (2) after original flow rate denotes that the syringe tip was replaced.

Version 1.1 / 13JUN2011 Approved by: [redacted] Date: 6/13/11

Study Number AEH-11-PSEUDO-02

File Folder: ____________ Lab book/pgs: ____________ Proofed: ____________ Reviewed: ____________

System Conditions – Form 3 Daily Flow Rates (mL/minute)

Mussel Species: ____________ **System ID:** ____________ **Block:** ____________ **Month:** ____________

Day	Days Post Exposure	1	2	3	4	5	6	7	8	9	10	11	12	Date	Time (military)	Initials
1																
2																
3																
4																
5																
6																
7																
8																
9																
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Note: Flow rates should be measured daily from four chambers in each block, resulting in each chamber being measured every three days. On the days that a chambers flow rate is not measured, that chambers flow rate should be visually observed for flow rate. Mark these observations as "VO" for visual observation.

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

File Folder: __________ Lab book/pgs: __________ Proofed: __________ Reviewed: __________

Weekly Water Quality – Form 5 Hardness, Alkalinity and Conductivity

System 1 Mussel Species: __________

System 2 Mussel Species: __________

System 3 Mussel Species: __________ **Instruments:** __________

System #	Chamber ID	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Conductivity (µS/cm)	Date	Time (military)	Initials
1							
2							
3							

System #	Chamber ID	pH	Temperature (°C)	Percent Transmittance (%T)	Total Ammonia Nitrogen[1] (mg/L)	Calculated Un-ionized Ammonia[1] (mg/L)	Date	Time (military)	Initials
1									
2									
3									

Note: Weekly water quality parameters will be measured from one chamber randomly selected from each system. For parameters requiring a water sample to be collected for analysis (hardness, alkalinity, and total ammonia nitrogen), water will be collected from the outflow section of each sampled exposure chambers.

Version 1.0 / 27MAY2011 Approved by: [redacted] Date: 6/2/11

Study Number AEH-11-PSEUDO-02
File Folder: ________ Lab book/pgs: [redacted] Proofed: ________ Reviewed: ________
Version 1.0/29JUN2011 Approved by: [redacted] Date: 7/5/2011

Juvenile Mussel Recovery Datasheet

System Number	Species	Chamber ID	Number of Mussels Recovered	Number of Viable Mussels	Comments	Date	Initials

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Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: [redacted] Proofed: ____________________ Reviewed: ____________________

Version 1.0/29JUN2011 Approved by: [redacted] ________ Date: 7/5/11

Juvenile Mussel Measurement Datasheet

System Number	Species	Chamber ID	Micropictograph ID	Mussel ID	Length (µm)	Date	Initials

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Study Number AEH-11-PSEUDO-02

File Folder: __________ Lab book/pgs: __________ Proofed: __________ Reviewed: __________

Pipette Calibration

Pipette Brand/Model/SN: ______________________ **Tip Type:** ______________

Balance: ______________________ **Thermometer:** ______________________

Temperature: ______________ **Water Density[1] (g/mL):** ______________________

Pipette Setting (μL)	Rep #	Water Mass (g)	Date	Time (military)	Initials
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	Mean				
	Standard Deviation				

Relative Standard Deviation (Standard Deviation / Mean *100): ______________________

Pass or Fail (Pass = Relative Standard Deviation ≤ 1%): ______________________

Pipette Volume (Mean mass / Water Density[1]): ______________________

Note: Pipette calibration must be performed with deionized water left to adjust to ambient room temperature for at least 24 hours prior to calibration.

[1] Water density (g/mL) at varying temperatures: 18°C: 0.9985976; 19°C: 0.9984073; 20°C: 0.9982063; 21°C: 0.9979948; 22°C:0.9977730.

Approved by: [redacted] Date: 7/13/11

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Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 08 DEC 2011

Algae Stock Preparation Chart

Version 1.4 Effective Date 08 DEC 2011 Initials JAL

Chlorella Dry wt	**1.9 %**
Nanno Dry wt	**20.48 %**
Tetra Dry wt	**17.93 %**
Delivery pump setting	**2.0 mL/min**

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	19.07	1.77	2.02
301	541.8	2.0	3.6	545.4	363.6	19.14	1.78	2.03
302	543.6	2.0	3.6	547.2	364.8	19.20	1.78	2.03
303	545.4	2.0	3.6	549.0	366.0	19.26	1.79	2.04
304	547.2	2.0	3.6	550.8	367.2	19.33	1.79	2.05
305	549.0	2.0	3.6	552.6	368.4	19.39	1.80	2.05
306	550.8	2.0	3.6	554.4	369.6	19.45	1.80	2.06
307	552.6	2.0	3.6	556.2	370.8	19.52	1.81	2.07
308	554.4	2.0	3.6	558.0	372.0	19.58	1.82	2.07
309	556.2	2.0	3.6	559.8	373.2	19.64	1.82	2.08
310	558.0	2.0	3.6	561.6	374.4	19.71	1.83	2.09
311	559.8	2.0	3.6	563.4	375.6	19.77	1.83	2.09
312	561.6	2.0	3.6	565.2	376.8	19.83	1.84	2.10
313	563.4	2.0	3.6	567.0	378.0	19.89	1.85	2.11
314	565.2	2.0	3.6	568.8	379.2	19.96	1.85	2.11
315	567.0	2.0	3.6	570.6	380.4	20.02	1.86	2.12
316	568.8	2.0	3.6	572.4	381.6	20.08	1.86	2.13
317	570.6	2.0	3.6	574.2	382.8	20.15	1.87	2.13
318	572.4	2.0	3.6	576.0	384.0	20.21	1.88	2.14
319	574.2	2.0	3.6	577.8	385.2	20.27	1.88	2.15
320	576.0	2.0	3.6	579.6	386.4	20.34	1.89	2.16
321	577.8	2.0	3.6	581.4	387.6	20.40	1.89	2.16
322	579.6	2.0	3.6	583.2	388.8	20.46	1.90	2.17

Study Number AEH-11-PSEUDO-02

File Folder: ________ Lab book/pgs: [redacted] Proofed: ____________ Reviewed: ____________

Version 1.0/29JUN2011 Approved by: [redacted] Date: 7/5/11

Juvenile Mussel Micropictograph Datasheet

System Number	Species	Chamber ID	Micropictograph ID	Date	Initials

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Study Number AEH-11-PSEUDO-02

File Folder: ___________ Lab book/pgs: ___________ Proofed: ___________ Reviewed: __________

Water Quality Form 2

Exposure Period Dissolved Oxygen, pH, Temperature

Mussel Species: ___________________ **System ID:** ____ **Instruments:** ______________________

Chamber ID	Dissolved Oxygen (mg/L)	pH	Temperature (°C)	Date	Time (military)	Initials

These data forms were revised from JAN 11-18①, 2012 and will no longer be used. KLW 18 JAN 2012

Note: Dissolved oxygen, pH, and temperature will be measured at least twice during the exposure period in every exposure chamber.

①Wrote wrong date. Should be Jan 11-18, 2012. KLW 18 JAN 2012

Version 1.0 / 01JUN2011 Approved by: [redacted] Date: 6/2/11

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Appendix 2. Deviations From the Study Protocol

Item number	Item description	Number of pages	Report page number
1	Deviation 1: Algae feed delivery line incorrectly inserted into pump; feed not supplied for ≈24 h	1	131
2	Deviation 2: Dry weight of chlorella not measured prior to use for feeding	1	132
3	Deviation 3: Algae feed delivery line obstructed; only ≈20% of feed rationed for ≈24 h	1	133
4	Deviation 4: Low water level in test chamber due to standpipe leak and water delivery line obstruction	1	134
5	Deviation 5: Power outage interrupted algae delivery pumps for ≈12 h	1	135
6	Deviation 6: Decreased number of preserved mussels for initial mussel valve length	2	136
7	Deviation 7: Microphotograph overwritten and restored	1	138
8	Deviation 8: Dosing stock solutions for 300 mg/L heat deactivated and 50 mg/L active solutions incorrectly prepared	1	139
9	Deviation 9: Conductivity meter incorrectly calibrated	1	140
10	Deviation 10: Algae feed delivery line obstructed; only ≈20% of feed rationed for 24 h	1	141
11	Deviation 11: Algae feed delivery line crimped causing clog; only ≈20% of feed rationed for ≈24 h – Dated April 27, 2012	1	142
12	Deviation 12: Low water level in test chamber due to standpipe leak	1	143

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: June 27, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 1 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #1 – Section 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that "exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox".

On June 16, 2011 the algae feed delivery line for system 1 (containing *Ligumia recta*) was found to have been incorrectly inserted into the pump after cleaning on 15 June 2011. Therefore, system 1 was inadvertently not feed for approximately 24 hours. Upon discovery on June 16, 2011 the feed supply was corrected as soon as possible.

No adverse impacts to the study are anticipated as a result of this deviation, however, the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted]
James A. Luoma, B.A.
Study Director, UMESC

6/27/11
Date

cc: UMESC QAU

FF # 3
Item No. 13
Pg 1 of 1

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: June 27, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 2 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #2 – Section 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled ""Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that "exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox".

On June 23, 2011 I was made aware that the first bottle of chlorella from the second batch of algae received from Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation had been exhausted and that a dry weight determination for the second bottle of the same batch had not been performed after the algae had been refreshed by the replacement of suspension water. I instructed study personnel to use the existing dry weight data from the first bottle of batch 2 until new dry weight data becomes available for the second bottle.

The second bottle of algae was used for preparing feed stocks from 6/24-26/2011 using the algae stock preparation chart (version 1.1) which utilized a chlorella dry weight of 2.9% for the calculations. On 6/27/2011, the data for the dry weight of the second batch was available and a new algae stock preparation chart (version 1.2) was prepared with the new chlorella dry weight of 2.58%.

Due to the slight reduction to the overall feeding rate, no adverse impacts to the study are anticipated as a result of this deviation.

[redacted]

James A. Luoma, B.A.
Study Director, UMESC

6/27/11
Date

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: June 27, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 3 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #3 – Section 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled ""Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that "exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox".

On June 26, 2011 the algae feed delivery line for systems 2 and 3 (containing *Lampsilis cardium* and *Lampsilis higginsii*, respectively) were found to be partially obstructed and therefore, systems 2 and 3 received approximately 20% of the feed ration for the previous 24 hours. Upon discovery on June 26, 2011 the feed supply was corrected as soon as possible.

No adverse impacts to the study are anticipated as a result of this deviation, however, the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted]
James A. Luoma, B.A.
Study Director, UMESC

6/27/11
Date

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: July 1, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 4 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #4 – Sections 4.1 and 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled ""Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" state that mussels will be reared in a flow through test apparatus and that exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae and Reed Mariculture tetraselmis and nannochloropsis instant algae.

On June 30, 2011 at ~0800 h two exposure chambers were discovered to have low water levels (system 1 (*Ligumia recta*) chamber 1B4 and system 2 (*Limpsilis cardium*) chamber 2B11). Chamber 2B11 of system 2 (*L. cardium*) was observed to have a reduced water level (< 3 cm decrease) but water inflow remained. Chamber 1B4 of system 1 (*L. recta*) was observed to have no water inflow into the chamber and a water level of approximately 2.5 cm.

On June 29, 2011 at approximately 1430 h the exposure chambers were cleaned by brushing the outer sections of the exposure chambers, removing the standpipe corks and allowing the chamber to drain to approximately 20% of volume, then reseating the standpipe corks and allowing the chambers to refill. The chambers were visually inspected at 1645 h and were observed to be full with water inflow. It is concluded that the standpipe corks were not adequately reseated after chamber cleaning and therefore a slow leak was present. It is further concluded that obstructions in the delivery lines reduced (system 2, chamber 2B11) or eliminated (system 1, chamber 1B4) water inflow into the chambers and the leaks caused the water levels to drop.

Upon discovery the standpipe corks were reseated and full water flow was restored to the exposure vessels.

No adverse impacts to the study are anticipated as a result of this deviation, however, the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted]

James A. Luoma, B.A.
Study Director, UMESC

7/1/11
Date

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: July 7, 2011
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 5 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #5 – Section 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled ""Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that "exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox".

At approximately 2230 h on July 1, 2011 a brief power interruption to the center caused the algae delivery pumps for systems 1, 2 and 3 (containing *Lampsilis higginsii*, *Lampsilis cardium* and *Lampsilis higginsii*, respectively) to stop delivering algae to the headboxes. The UMESC backup generator restored power to the pumps within approximately two minutes, however the pumps did not restart when the power was restored. The loss of food was discovered and corrected at approximately 1000 h on July 2, 20ll.

No adverse impacts to the study are anticipated as a result of this deviation, however, the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted]
James A. Luoma, B.A.
Study Director, UMESC

7/7/11
Date

cc: UMESC QAU

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Pg 1 of 1

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: December 13, 2011

To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 6 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #6 – Sections 5.5.1 and 6.2 (Survival and Growth and Determination of Survival and Growth) of the amended protocol states that the growth of the newly metamorphosed juveniles from each dosing concentration will be assessed by "comparing valve length measurements from photomicrograph records captured and analyzed using Nikon Elements BR ® software. Comparisons will be made between treatments as well as to mussels images recorded prior to the test initiation." According to Section 4.2 (Experimental Design), the mussel images recorded prior to the test initiation were to come from "two randomly chosen groups of 20 mussels of each species [that were preserved] to determine the initial mussel valve length."

The procedures as described in the protocol were followed except three randomly chosen groups of 20 mussels of each species were preserved to determine the initial mussel valve length. On August 8, 2011 when the preserved mussel samples were photographed for initial valve length measurements, it was found that many of the samples did not have 20 mussels. The exact cause of the decreased number of preserved mussels for initial valve lengths is unclear; however, there are a few potential causes: 1) 20 mussels were not originally counted for the sample; 2) the mussels were not washed properly into the sample vial for preservation; 3) mussels were inadvertently removed from the sample when the 10% NBF was replaced with 70% ethanol due to some of the mussels floating; 4) Not all mussels were removed from the sample vial when the initial valve length photographs were taken; 5) Due to some of the mussels floating, they may not have been noticed sticking to the side of the petri dish during photographing.

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No adverse impacts to the study are anticipated as a result of this deviation. The total number of mussels photographed from the three preserved samples for the initial valve lengths is greater than the originally proposed 40 mussels in two samples.

[redacted] 13 DEC 2011

Written by
Kerry L. Weber, M.S.
Principal Investigator, UMESC
Date

[redacted] 17 Dec 2011

Approved by
James A. Luoma, B.A.
Study Director, UMESC
Date

cc: UMESC QAU

FF # 3 wrong item number
Item No. ~~16~~ K RW 31 OCT 14
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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: December 13, 2011

To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 7 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed mussels from seven different unionid species"

Deviation #7 – Sections 4.2 and 6.2 (Experimental Design and Determination of viability) state that "a photomicrograph of all surviving mussels will be recorded for each exposure chamber for growth measurements." One photograph (PPB-2A2-3x-Live.tif) taken on July 9, 2011 was over-written on August 8, 2011. The photograph was restored by Martin Tagesen using the network back-up from July 9, 2011.

No negative impacts to the study are anticipated as the photograph was restored to its original file before analysis was conducted.

[redacted] 13 DEC 2011

Written by
Kerry L. Weber, M.S.
Principal Investigator, UMESC
Date

[redacted] 13 Dec 2011

Approved by
James A. Luoma, B.A.
Study Director, UMESC
Date

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Pg 1 of 1

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: December 13, 2011

To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 8 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed mussels from seven different unionid species"

Deviation #8 – The stock dosing solutions for the 300 mg/L heat deactivated and the 50 mg/L active solutions were incorrectly prepared and temporarily (≤ 20 minutes) used for exposing the 300 mg/L heat deactivated and 50 mg/L active exposure vessels. When the dosing solutions were prepared, less dilution water was used then was required due to an error in reading the Chemical Stock Solution Determination data sheet. The dilution water initially used was total volume required (5,000 mL) minus the mg (read as mL in error) of test material required (1,500 mg for heat deactivated; 250 mg for the 50 mg/L active), instead of the total volume required (5,000 mL) minus the aliquot of stock required (150 mL stock C for the 300 mg/L heat deactivated; 25 mL stock B for the 50 mg/L active).

This error was noticed immediately after dosing the 50 mg/L exposure chambers and new dose solutions were prepared and then used to flush and refill the chambers. The incorrect dosage was in the chambers no more than 20 minutes. The incorrect dosage of material used was calculated to be ~52 mg/L for the 50 mg/L chambers and ~411 mg/L for the heat deactivated chambers.

No negative impacts to the study are anticipated as: 1) the incorrect dosage was in the exposure chambers for a brief time (≤ 20 minutes); 2) the heat deactivate material is denatured and it is believed that any toxicity would be from longer term exposure and likely associated ammonia production; and 3) the dose that the 50 mg/L chambers received was ~4% above the target dose.

[redacted] 13 Dec 11
James A. Luoma, B.A. Date
Study Director, UMESC

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Pg 1 of 1

cc: UMESC QAU

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: February 7, 2012

To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 9 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens (Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" Deviation #9 – Sections 5.2.6 (Conductivity) of the amended protocol for study number study number AEH-11-PSEUDO-02 states that "the conductivity will be measured and recorded prior to test initiation and upon exposure termination from pooled replicate samples of each test concentration. Additionally, the conductivity will be measured weekly throughout the holding period on one representative exposure chamber from each species (UMESC SOP AEH 188 or equivalent)."

On January 28, 2012, the procedures as described in the protocol were followed, however, during the calibration of the conductivity meter, the wrong temperature was inadvertently used to derive the temperature corrected conductivity values. The value used to calibrate the conductivity meter and recorded in the logbook was for the temperature of 19.7°C (896µS) instead of 20.7°C (915 µS). This error was caused by reading the number in the chart directly above the correct temperature correct conductivity value.

A second error was found in the calibration of the conductivity meter during the 10µS standard for January 28, 2012. The value used to calibrate the conductivity meter and recorded in the logbook was 8.87µS. This value should have been 8.84µS. This indicates a recording error as well as an improper calibration point for the conductivity meter.

The adverse impacts to the study are considered negligible for the following reasons:

1) The incorrect values used to calibrate the meter were reasonably close to the values that should have been used (≤ 19µS difference).
2) The conductivity data collected on January 28, 2012 were similar to data collected during exposures to glochidia (study # AEH-11-PSEUDO-01) using the same lot of product.
3) Conductivity measurements are ancillary information, not primary endpoints for used for statistical comparison.

[redacted]	7FEB2012	[redacted]	7Feb12
Written by	Date	Approved by	Date
Jeremy K. Wise, B.S.		James A. Luoma, B.A.	
Bio Science Tech, UMESC		Study Director, UMESC	

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Item No. 21
Pg 1 of 1

cc: UMESC QAU

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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: April 27, 2012
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 10 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #10 – Section 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled ""Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that "exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox".

On April 24, 2012 the algae feed delivery line for system 2 (containing *Ligumia recta*) was found to be partially obstructed and therefore, system 2 received approximately 20% of the feed ration for the previous 24 hours. Upon discovery on April 24, 2012 the feed supply was corrected as soon as possible.

Adverse impacts to the study as a result of this deviation are unknown; the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted] 27APR12
Written by Date
Kerry L. Weber, M.S.
Principal Investigator, UMESC

[redacted] 4/27/12
Approved by Date
James A. Luoma, B.A.
Study Director, UMESC

cc: UMESC QAU

FF # 3
Item No. 22
Pg 1 of 1

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: April 27, 2012
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 11 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #11 – Section 5.1.6 of study number AEH-11-PSEUDO-02 amended protocol entitled ""Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that "exposure chambers will receive a constant supply of 2.0 mg/L (dry weight) of a 1:1:1 mixture of live chlorella algae (obtained from the Kentucky Department of Fish and Wildlife Resources Center for Mollusk Conservation) and Reed Mariculture tetraselmis and nannochloropsis instant algae. This mixture approximates the diet that produced the greatest survival in similar exposures with *Lampsilis cardium* and *L. siliquoidea* (Meinertz 2008). A fresh food stock solution will be prepared daily and delivered with a peristaltic pump to the headbox".

On April 25, 2012 the algae feed delivery line for system 2 (containing *Ligumia recta*) was found to be crimped by a holding clamp causing the line to clog. Therefore, system 2 received approximately 20% of the feed ration for the previous 24 hours. Upon discovery on April 25, 2012 the feed supply was corrected as soon as possible.

Adverse impacts to the study as a result of this deviation are unknown; the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted] 27APR12

Written by — Date
Kerry L. Weber, M.S.
Principal Investigator, UMESC

[redacted] 4/27/12

Approved by — Date
James A. Luoma, B.A.
Study Director, UMESC

cc: UMESC QAU

FF # 3
Item No. 23
Pg 1 of 1

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Biological Resources Division
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603

MEMORANDUM

Date: May 18, 2012
To: The Record Study Number AEH-11-PSEUDO-02

Subject: Deviation 12 to study AEH-11-PSEUDO-02 "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Deviation #12 – Sections 5.4.1.2 and 5.4.1.3 of study number AEH-11-PSEUDO-02 amended protocol entitled "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species" states that each exposure vessel will receive a continuous supply of temperature adjusted (20°C) well water from the distribution box at a rate to provide approximately 1 chamber exchange per hour.

At approximately 1030 h, during post-exposure water chemistry and setting of flow rates to holding chambers it was observed that all chambers were filled and there were no apparent issues. At approximately 1400 h on May 17, 2012, it was found that holding chamber 1B2 contained approximately 2.5 cm of water. Once discovered, the standpipes were reseated in the chamber and the chamber was filled with acclimated well water in the inflow section of the chamber. The chamber was periodically monitored for an additional 2 hours to determine that the problem was resolved. No further action was required. It is assumed that the emptying of holding chamber 1B2 occurred over a 3.5 hour span due to a slow leak caused by the improper seating of the inflow standpipe from the termination of dosing.

Adverse impacts to the study as a result of this deviation are unknown; the impact of this deviation to the outcome of the study will not be fully known until the viability data are analyzed. Therefore, an assessment of the impact of this deviation will be rendered in the final study report.

[redacted] 18MAY12
Written by
Kerry L. Weber, M.S.
Principal Investigator, UMESC
Date

[redacted] 5/18/12
Approved by
James A. Luoma, B.A.
Study Director, UMESC
Date

cc: UMESC QAU

FF # 3
Item No. 24
Pg 1 of 1

Appendix 3. Randomization Assignments

Item number	Item description	Number of pages	Report page number
1	SAS generated random assignment of species to test system – dated July 7, 2011	4	145
2	SAS generated random assignment of species to test system – dated December 8, 2011	3	149
3	SAS generated random assignment of species to test system – dated January 23, 2012	4	152
4	SAS generated random assignment of species to test system – dated March 28, 2012	4	156
5	SAS generated random assignment of species to test system – dated May 2, 2012	4	160
6	SAS generated random assignment of species to test system – dated May 23, 2012	4	164
7	SAS generated random assignment of juvenile mussel distribution – dated July 7, 2011	7	168
8	SAS generated random assignment of juvenile mussel distribution – dated December 8, 2011	7	175
9	SAS generated random assignment of juvenile mussel distribution – dated January 23, 2012	13	182
10	SAS generated random assignment of juvenile mussel distribution – dated March 28, 2012	6	195
11	SAS generated random assignment of juvenile mussel distribution – dated May 2, 2012 for *Lampsilis cardium*	6	201
12	SAS generated random assignment of juvenile mussel distribution – dated May 23, 2012	8	207
13	SAS generated random assignment of treatment to experimental tanks – dated July 7, 2011	10	215
14	SAS generated random assignment of treatment to experimental tanks – dated December 8, 2011	9	225
15	SAS generated random assignment of treatment to experimental tanks – dated January 23, 2012	18	234
16	SAS generated random assignment of treatment to experimental tanks – dated March 28, 2012	7	252
17	SAS generated random assignment of treatment to experimental tanks – dated May 2, 2012	7	259
18	SAS generated random assignment of treatment to experimental tanks – dated May 23, 2012	8	266

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species AEH-11-PSEUDO-02 1
AEH-11-PSUEDO-02
Random assignment of mussel species to block

Obs	block	x	blocka	sps
1	1	0.52805	System 1	Hickory nut
2	2	0.56107	System 2	Mucket
3	3	0.78855	System 3	blank

Log Book / Pages 2/5-6
File Folder 12K
Initials KW Date 27JUL11

PROOFED BY
Initials: KW Date: 27JUL11
REVIEWED BY
Initials: Date:
not needed KW 27JUL11

Item Number: 2

Pg 1 of 4

Analysis performed by M. Gaikowski SAS version 9.2 15:39 07JUL11 MPG

```
*  date created  : 07Jul11 - MPG
*  Verified by:  _______ (Date:_______)                          page _ ___ of ____
*  Random allocation of mussel species to block.test 2.sas
*********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by M. Gaikowski SAS version ' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

/*Random assignment of mussel species to block*/

data sps;
 do block = 1 to 3 by 1;
   x = ranuni(-1);
   output;
 end;
run;

NOTE: The data set WORK.SPS has 3 observations and 2 variables.
NOTE: DATA statement used (Total process time):
      real time           0.43 seconds
      cpu time            0.15 seconds


proc sort data=sps;
 by x;
run;

NOTE: There were 3 observations read from the data set WORK.SPS.
NOTE: The data set WORK.SPS has 3 observations and 2 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.12 seconds
      cpu time            0.07 seconds


data block; set sps;
if block = 1 then blocka = 'System 1';
if block = 2 then blocka = 'System 2';
if block = 3 then blocka = 'System 3'; run;

NOTE: There were 3 observations read from the data set WORK.SPS.
NOTE: The data set WORK.BLOCK has 3 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


data assign_sps; set block;
 if _n_ = 1 then sps = 'Hickory nut';
  if _n_ = 2 then sps = 'Mucket';
   if _n_ = 3 then sps = 'blank';
 run;

NOTE: There were 3 observations read from the data set WORK.BLOCK.
NOTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

Log Book / Pages 25-6
File Folder 12A
Initials KW Date 27Jul11

PROOFED BY
Initials: KW Date: 27Jul11
REVIEWED BY
Initials ____ Date ____
not needed
kw 7nov14

Pg 2 of 4

```
proc sort data=assign_sps;
 by block;
run;

NOTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
NOTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc print data= assign_sps;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species  ';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of mussel species to block';
run;

NOTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.24 seconds
      cpu time            0.07 seconds
```

Log Book / Page 2/5-b
File Folder 12k
Initials KW Date 27Jul11

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Initials: KW Date: 27Jul11
REVIEW
Initials: ___ Date: ___

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Pg 3 of 4

AEH-11-PSEUDO-02

```
/***********************************************************************
*  Study Number  : AEH-11-PSUEDO-02
*  Study Director: Jim Luoma
*  date created  : 07Jul11 - MPG  MM
*  Verified by:  _______ (Date:_______)                    page ____ of ____
*  Random allocation of mussel species to block.test 2.sas
***********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by M. Gaikowski SAS version ' &SYSVER &SYSTIME &SYSDATE;

options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

/*Random assignment of mussel species to block*/

data sps;
 do block = 1 to 3 by 1;
   x = ranuni(-1);
   output;
 end;
run;
proc sort data=sps;
 by x;
run;
data block; set sps;
if block = 1 then blocka = 'System 1';
if block = 2 then blocka = 'System 2';
if block = 3 then blocka = 'System 3'; run;
data assign_sps; set block;
 if _n_ = 1 then sps = 'Hickory nut';
  if _n_ = 2 then sps = 'Mucket';
   if _n_ = 3 then sps = 'blank';
 run;
 proc sort data=assign_sps;
 by block;
run;
proc print data= assign_sps;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species  ';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of mussel species to block';
run;
```

Log Book / Page 215-6
File Folder 12A 27JUL11
Initials KLW

PROOFED BY
Initials: KLW Date: 27JUL11
REVIEWED BY
Initials: ____ Date: ____
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KLW 7nov14

Item Number: 2

Pg 4 of 4

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
AEH-11-PSUEDO-02
Random assignment of mussel species to block

JM
08 Dec 2011

Obs	block	x	blocka	sps
1	1	0.70364	System 1	empty
2	2	0.45820	System 2	washboard
3	3	0.07683	System 3	Black sandshell

AEH-11-PSEUDO-02

Log Book / Pages 2/25
File Folder 12A
Initials KW Date 21 DEC 11

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Initials: ______ Date: ______
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KW 7 NOV 14

Item Number: 3

Page 1 of 3

Analysis performed by Jim Luoma SAS version 9.2 08:22 08DEC11

Log Book / Pages 2/25
File Folder 124
Initials KMW Date 7Nov14

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REVIEWED BY
Initials: ____ Date: ____

Not needed KMW 7Nov14

AEH-11-PSEUDO-02

Page 2 of 3

```
/*******************************************************************
*. Study Number  : AEH-11-PSUEDO-02
*  Study Director: Jim Luoma
*  date created  : 08DEC11 - JAL
*  Verified by:  _______ (Date:_______)                    page ____ of ____
*  Random allocation of mussel species to block.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

/*Random assignment of mussel species to block*/

data sps;
 do block = 1 to 3 by 1;
   x = ranuni(-1);
   output;
 end;
run;
proc sort data=sps;
 by x;
run;
data block; set sps;
if block = 1 then blocka = 'System 1';
if block = 2 then blocka = 'System 2';
if block = 3 then blocka = 'System 3'; run;
data assign_sps; set block;
 if _n_ = 1 then sps = 'Black sandshell';
  if _n_ = 2 then sps = 'washboard';
   if _n_ = 3 then sps = 'empty';
 run;
 proc sort data=assign_sps;
 by block;
run;
proc print data= assign_sps;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species  ';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of mussel species to block';
run;
```

AEH-11-PSEUDO-02

JAL 08Dec2011

Log Book / Pages 2/25
File Folder 12A
Initials KW Date 7nov14

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Item Number: 3

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Page ~~4~~ 3 of 3

uvenile mussels from seven different unionid species
.EH-11-PSUEDO-02
andom assignment of mussel species to system JAN 1-23-2012

AEH-11-PSEUDO-02

~~AEH~~ NC KW 7NOV14

bs	block	x	blocka	sps
1	1	0.47947	System 1	Fatmucket
2	2	0.99238	System 2	empty
3	3	0.56137	System 3	empty

Log Book / Pages 2/32
File Folder 12A
Initials KW Date 12 APR 12

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REVIEWED BY
Initials: Date:

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Item Number: 4

Page 1 of ~~4~~ 3 ① 4

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① Missed 4th page KW 7NOV14

nalysis performed by Jim Luoma SAS version 9.2 08:45 23JAN12

```
Study Number  : AEH-11-PSUEDO-02
·Study Director: Jim Luoma
date created  : 23JAN12 - JAL JAL
Verified by:  _______ (Date:_______)              page ____ of ____
Random allocation of mussel species to system.sas
*****************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

*Random assignment of mussel species to System*/

ata sps;
do block = 1 to 3 by 1;
  x = ranuni(-1);
  output;
end;
un;
roc sort data=sps;
by x;
un;
ata block; set sps;
f block = 1 then blocka = 'System 1';
f block = 2 then blocka = 'System 2';
f block = 3 then blocka = 'System 3'; run;
ata assign_sps; set block;
if _n_ = 1 then sps = 'Fatmucket';
 if _n_ = 2 then sps = 'empty';
  if _n_ = 3 then sps = 'empty';
run;
proc sort data=assign_sps;
by block;
un;
roc print data= assign_sps;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species  ';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of mussel species to system';
un;
```

AEH-11-PSEUDO-02

Log Book / Pages 2/32
File Folder 12 A
Initials JLW Date 7nov14

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____

Not needed JLW 7nov14

Page 2 of ~~4~~ ~~3~~ 4 (1) wrong # of pages JLW 7nov14

(1) Missed 4th Page JLW 7nov14

```
*  Verified by: _______ (Date:____SA___)                     page ____ of ____
*  Random allocation of mussel species to system.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

/*Random assignment of mussel species to System*/

data sps;
 do block = 1 to 3 by 1;
   x = ranuni(-1);
   output;
 end;
run;

OTE: The data set WORK.SPS has 3 observations and 2 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


proc sort data=sps;
 by x;
run;

OTE: There were 3 observations read from the data set WORK.SPS.
OTE: The data set WORK.SPS has 3 observations and 2 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data block; set sps;
if block = 1 then blocka = 'System 1';
if block = 2 then blocka = 'System 2';
if block = 3 then blocka = 'System 3'; run;

OTE: There were 3 observations read from the data set WORK.SPS.
OTE: The data set WORK.BLOCK has 3 observations and 3 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data assign_sps; set block;
 if _n_ = 1 then sps = 'Fatmucket';
  if _n_ = 2 then sps = 'empty';
   if _n_ = 3 then sps = 'empty';
 run;

OTE: There were 3 observations read from the data set WORK.BLOCK.
```

AEH-11-PSEUDO-02

Log Book / Pages 2/32
File Folder 12A
Initials JAL Date 7nov14

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Initials: ____ ~~Date~~: ____
REVIEWED BY
Initials: ____ Date: ____
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JAL 7nov14

Item Number: 4

Page 3 of ~~3~~ 4
wrong # JAL 7nov14

```
OTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
OTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

Log Book / Pages 2/32
File Folder 12A
Initials KW Date 7Nov14

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REVIEWED BY
Initials: Date:

Not needed KW 7Nov14

AEH-11-PSEUDO-02

```
 proc sort data=assign_sps;
  by block;
 run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.00 seconds


 proc print data= assign_sps;
 title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
 title2 h=1 'juvenile mussels from seven different unionid species  ';
 title3 h=1 'AEH-11-PSUEDO-02';
 title4 h=1 'Random assignment of mussel species to system';
 run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.01 seconds
```

Item Number: 4

Page 4 of 4

uvenile mussels from seven different unionid species
.EH-11-PSUEDO-02
.andom assignment of mussel species to system

3-28-12
JA

AEH-11-PSEUDO-02

bs	block	x	blocka	sps
1	1	0.26750	System 1	empty
2	2	0.13851	System 2	Black Sandshell
3	3	0.86880	System 3	empty

File folder 12A
Lab Book 2 page 39
KMW 12APR12

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
Not needed
KMW 7NOV14

Item Number: 5

Page 1 of 4

nalysis performed by Jim Luoma SAS version 9.2 08:10 28MAR12

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*  date created  : 28MAR12 - JAL
*  Verified by:  _______ (Date:_______)                    page ____ of ____
*  Random allocation of mussel species to system.sas
*********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

/*Random assignment of mussel species to System*/

data sps;
 do block = 1 to 3 by 1;
   x = ranuni(-1);
   output;
 end;
run;

IOTE: The data set WORK.SPS has 3 observations and 2 variables.
IOTE: DATA statement used (Total process time):
     real time           0.00 seconds
     cpu time            0.01 seconds


proc sort data=sps;
 by x;
run;

IOTE: There were 3 observations read from the data set WORK.SPS.
IOTE: The data set WORK.SPS has 3 observations and 2 variables.
IOTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data block; set sps;
if block = 1 then blocka = 'System 1';
if block = 2 then blocka = 'System 2';
if block = 3 then blocka = 'System 3'; run;

IOTE: There were 3 observations read from the data set WORK.SPS.
IOTE: The data set WORK.BLOCK has 3 observations and 3 variables.
IOTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data assign_sps; set block;
 if _n_ = 1 then sps = 'Black Sandshell';
  if _n_ = 2 then sps = 'empty';
   if _n_ = 3 then sps = 'empty';
 run;

IOTE: There were 3 observations read from the data set WORK.BLOCK.
```

AEH-11-PSEUDO-02

Log Book / Pages 2/39
File Folder 12A
Initials JWL Date 3NOV14

PROOFED BY
Initials: ____ Date ____
REVIEWED BY
Initials: ____ Date: ____
not needed
JWL 3Nov14

Page 2 of 4

```
OTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

Log Book / Pages 2/39
File Folder 124
Initials [illegible] Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____

Not needed for 7Nov14

AEH-11-PSEUDO-02

```
proc sort data=assign_sps;
by block;
run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


proc print data= assign_sps;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species  ';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of mussel species to system';
run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds
```

Page 3 of 4

```
Study Number   : AEH-11-PSUEDO-02
Study Director: Jim Luoma
date created   : 28MAR12 - JAL Jm
Verified by:  _______ (Date:_______)                    page ____ of ____
Random allocation of mussel species to system.sas
*****************************************************************/
```

AEH-11-PSEUDO-02

```
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

*Random assignment of mussel species to System*/

ata sps;
do block = 1 to 3 by 1;
  x = ranuni(-1);
  output;
end;
un;
roc sort data=sps;
by x;
un;
ata block; set sps;
f block = 1 then blocka = 'System 1';
f block = 2 then blocka = 'System 2';
f block = 3 then blocka = 'System 3'; run;
ata assign_sps; set block;
if _n_ = 1 then sps = 'Black Sandshell';
 if _n_ = 2 then sps = 'empty';
  if _n_ = 3 then sps = 'empty';
run;
proc sort data=assign_sps;
by block;
un;
roc print data= assign_sps;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species  ';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of mussel species to system';
un;
```

Log Book / Pages 2/39
File Folder 12.4
Initials KW Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____

Not needed
KW 7Nov14

Page 4 of 4

Item Number: 5

ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed
uvenile mussels from seven different unionid species
EH-11-PSUEDO-02
andom assignment of mussel species to system

5/2/12
JL

AEH-11-PSEUDO-02

bs	block	x	blocka	sps
1	1	0.75336	System 1	Plain Pocketboo
2	2	0.36393	System 2	Blacksand shell
3	3	0.81421	System 3	empty

Log Book / Pages 2/45
File Folder 124
Initials KW Date 7nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
Not needed KW 7nov14

Item Number: 6

Page 1 of 4

nalysis performed by Jim Luoma SAS version 9.2 13:52 02MAY12

```
*  Verified by: _______ (Date: J___ )
*  Random allocation of mussel species to system.sas
**********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
'ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

/*Random assignment of mussel species to System*/

data sps;
 do block = 1 to 3 by 1;
   x = ranuni(-1);
   output;
 end;
run;

OTE: The data set WORK.SPS has 3 observations and 2 variables.
OTE: DATA statement used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


proc sort data=sps;
 by x;
run;

OTE: There were 3 observations read from the data set WORK.SPS.
OTE: The data set WORK.SPS has 3 observations and 2 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


data block; set sps;
if block = 1 then blocka = 'System 1';
if block = 2 then blocka = 'System 2';
if block = 3 then blocka = 'System 3'; run;

OTE: There were 3 observations read from the data set WORK.SPS.
OTE: The data set WORK.BLOCK has 3 observations and 3 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data assign_sps; set block;
 if _n_ = 1 then sps = 'Blacksand shell';
  if _n_ = 2 then sps = 'Plain Pocketbook';
   if _n_ = 3 then sps = 'empty';
 run;

OTE: There were 3 observations read from the data set WORK.BLOCK.
```

page ____ of ____

AEH-11-PSEUDO-02

Log Book / Pages 2/45
File Folder 124
Initials KW Date 3NOV14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
Not needed
Kim Fravel

Page 2 of 4

```
OTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

AEH-11-PSEUDO-02

Log Book / Pages 2/45
File Folder 124
Initials KW Date 7Nov14
PROOFED BY
Initials: ____ Date: ____ Not needed KW 7Nov14
REVIEWED BY
Initials: ____ Date: ____

```
proc sort data=assign_sps;
 by block;
run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


proc print data= assign_sps;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species  ';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of mussel species to system';
run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

```
Study Number  : AEH-11-PSUEDO-02
Study Director: Jim Luoma
date created  : 02May12 - JAL
Verified by:  _______ (Date:_______)                 page ____ of ____
Random allocation of mussel species to system.sas
*****************************************************************/
```

AEH-11-PSEUDO-02

```
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

*Random assignment of mussel species to System*/

ata sps;
do block = 1 to 3 by 1;
  x = ranuni(-1);
  output;
end;
un;
roc sort data=sps;
by x;
un;
ata block; set sps;
f block = 1 then blocka = 'System 1';
f block = 2 then blocka = 'System 2';
f block = 3 then blocka = 'System 3'; run;
ata assign_sps; set block;
if _n_ = 1 then sps = 'Blacksand shell';
 if _n_ = 2 then sps = 'Plain Pocketbook';
  if _n_ = 3 then sps = 'empty';
run;
proc sort data=assign_sps;
by block;
un;
roc print data= assign_sps;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species  ';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of mussel species to system';
un;
```

Log Book / Pages 2/45
File Folder 12A
Initials RW Date 7nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:

Not needed
RW 7nov14

Item Number: 6

Page 4 of 4

uvenile mussels from seven different unionid species
.EH-11-PSUEDO-02
andom assignment of mussel species to system

5/23/12
JL

AEH-11-PSEUDO-02

Log Book / Pages 2/49
File Folder 124
Initials KW Date 7NOV14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
Not needed
KW 7NOV14

bs	block	x	blocka	sps
1	1	0.28107	System 1	Higgins eye
2	2	0.34405	System 2	empty
3	3	0.91434	System 3	empty

Item Number: 7

Page 1 of 4

nalysis performed by Jim Luoma SAS version 9.2 07:10 23MAY12

```
        *  Verified by:  _______ (Date:_______)                    page ____ of ____
        *  Random allocation of mussel species to system.sas
        *****************************************************************/
        DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;
```

AEH-11-PSEUDO-02

```
        FOOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
/ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

        options /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

        /*Random assignment of mussel species to System*/

        data sps;
         do block = 1 to 3 by 1;
           x = ranuni(-1);
           output;
         end;
        run;

OTE: The data set WORK.SPS has 3 observations and 2 variables.
OTE: DATA statement used (Total process time):
      real time           0.10 seconds
      cpu time            0.11 seconds


        proc sort data=sps;
         by x;
        run;

OTE: There were 3 observations read from the data set WORK.SPS.
OTE: The data set WORK.SPS has 3 observations and 2 variables.
OTE: PROCEDURE SORT used (Total process time):
      real time           0.05 seconds
      cpu time            0.03 seconds


        data block; set sps;
        if block = 1 then blocka = 'System 1';
        if block = 2 then blocka = 'System 2';
        if block = 3 then blocka = 'System 3'; run;

OTE: There were 3 observations read from the data set WORK.SPS.
OTE: The data set WORK.BLOCK has 3 observations and 3 variables.
OTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


        data assign_sps; set block;
         if _n_ = 1 then sps = 'Higgins eye';
          if _n_ = 2 then sps = 'empty';
           if _n_ = 3 then sps = 'empty';
         run;

OTE: There were 3 observations read from the data set WORK.BLOCK.
```

Log Book / Pages 2/49
File Folder 124
Initials KW Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____

not needed
KW 7Nov14

Page 2 of 4

```
)TE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
)TE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


      proc sort data=assign_sps;
      .by block;
      run;

)TE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
)TE: The data set WORK.ASSIGN_SPS has 3 observations and 4 variables.
)TE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


      proc print data= assign_sps;
      title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
      title2 h=1 'juvenile mussels from seven different unionid species  ';
      title3 h=1 'AEH-11-PSUEDO-02';
      title4 h=1 'Random assignment of mussel species to system';
      run;

OTE: There were 3 observations read from the data set WORK.ASSIGN_SPS.
OTE: PROCEDURE PRINT used (Total process time):
      real time           0.07 seconds
      cpu time            0.07 seconds
```

AEH-11-PSEUDO-02

Log Book / Pages 2/49
File Folder 12A
Initials LMV Date 7nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed YMW 7nov14

Page 3 of 4

```
Study Number   : AEH-11-PSUEDO-02
Study Director: Jim Luoma
date created   : 23May12 - JAL JA
Verified by:  _______ (Date:_______)                      page ____ of ____
Random allocation of mussel species to system.sas
*****************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by Jim Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions /*ls=85 ps=40 formdlim='-' */ pageno = 1 nocenter nodate nosource2;

*Random assignment of mussel species to System*/

ata sps;
do block = 1 to 3 by 1;
  x = ranuni(-1);
  output;
end;
un;
roc sort data=sps;
by x;
un;
ata block; set sps;
f block = 1 then blocka = 'System 1';
f block = 2 then blocka = 'System 2';
f block = 3 then blocka = 'System 3'; run;
ata assign_sps; set block;
if _n_ = 1 then sps = 'Higgins eye';
 if _n_ = 2 then sps = 'empty';
  if _n_ = 3 then sps = 'empty';
run;
proc sort data=assign_sps;
by block;
un;
roc print data= assign_sps;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species  ';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of mussel species to system';
un;
```

AEH-11-PSEUDO-02

Log Book / Pages 2/49
File Folder 12A
Initials KW Date 7Nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed
KW 7Nov14

Item Number: 7

Page 4 of 4

AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels
Random assignment of Hickory nut to test tanks

1

1220 start PLM 11JUL11
1420 End PLM 11JUL11

Obs	round	block	tank	x	tankn
1	1	2	4	0.00877	1B4
2	1	1	6	0.05068	1A6
3	1	1	1	0.18738	1A1
4	1	2	3	0.21083	1B3
5	1	2	11	0.30291	1B11
6	1	2	9	0.31814	1B9
7	1	2	2	0.36520	1B2
8	1	1	3	0.43073	1A3
9	1	2	10	0.43568	1B10
10	1	1	12	0.50123	1A12
11	1	2	1	0.54942	1B1
12	1	2	12	0.54971	1B12
13	1	1	8	0.57218	1A8
14	1	1	7	0.57914	1A7
15	1	2	7	0.62041	1B7
16	1	1	10	0.63797	1A10
17	1	1	9	0.67336	1A9
18	1	2	6	0.74765	1B6
19	1	2	5	0.77627	1B5
20	1	1	2	0.80041	1A2
21	1	2	8	0.87595	1B8
22	1	1	4	0.90752	1A4
23	1	1	11	0.94774	1A11
24	1	1	5	0.95988	1A5
25	2	2	1	0.00698	1B1
26	2	2	3	0.02173	1B3
27	2	1	5	0.09532	1A5
28	2	1	12	0.11693	1A12
29	2	1	9	0.12837	1A9
30	2	1	2	0.13060	1A2
31	2	2	2	0.19784	1B2
32	2	2	8	0.25343	1B8
33	2	1	10	0.32505	1A10
34	2	1	8	0.33478	1A8
35	2	2	11	0.38318	1B11
36	2	1	1	0.43935	1A1
37	2	2	10	0.46635	1B10
38	2	1	4	0.51265	1A4
39	2	2	7	0.57911	1B7
40	2	1	3	0.63867	1A3
41	2	2	4	0.65090	1B4
42	2	1	7	0.76733	1A7
43	2	1	6	0.76752	1A6
44	2	2	12	0.83676	1B12
45	2	2	9	0.87156	1B9
46	2	2	5	0.89813	1B5
47	2	2	6	0.97191	1B6
48	2	1	11	0.99462	1A11

Log Book / Pages 2/5-6
File Folder 12B
Initials KLW Date 27JUL11

PROOFED BY
Initials: KLW Date: 27JUL11
R_VIEWE
Initials: ____ Date: ____
not needed KLW 27JUL11

Item Number: 2

Pg 1 of 7

Analysis performed by M. Gaikowski SAS version 9.2 15:39 07JUL11 MM

AEH-11-PSEUDO-02

AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels 2

Random assignment of Mucket to test tanks

Start 1215 13JUL11 PLM
End 1429 13JUL11 PLM

Obs	round	block	tank	x	tankn
1	1	2	10	0.04255	2B10
2	1	2	2	0.06564	2B2
3	1	1	10	0.14967	2A10
4	1	1	1	0.15051	2A1
5	1	1	12	0.15927	2A12
6	1	1	6	0.19244	2A6
7	1	1	5	0.24452	2A5
8	1	2	8	0.28944	2B8
9	1	1	3	0.40027	2A3
10	1	2	7	0.41455	2B7
11	1	2	4	0.47403	2B4
12	1	2	11	0.47609	2B11
13	1	1	2	0.47895	2A2
14	1	2	6	0.51826	2B6
15	1	1	8	0.61607	2A8
16	1	1	7	0.66369	2A7
17	1	2	1	0.67986	2B1
18	1	2	3	0.69606	2B3
19	1	2	9	0.78960	2B9
20	1	2	5	0.79262	2B5
21	1	1	11	0.83901	2A11
22	1	1	4	0.85285	2A4
23	1	1	9	0.95029	2A9
24	1	2	12	0.96452	2B12
25	2	2	7	0.01140	2B7
26	2	1	12	0.01204	2A12
27	2	1	4	0.07047	2A4
28	2	1	11	0.13815	2A11
29	2	1	3	0.17294	2A3
30	2	2	4	0.26088	2B4
31	2	1	6	0.28092	2A6
32	2	1	9	0.28404	2A9
33	2	2	9	0.38778	2B9
34	2	1	5	0.42228	2A5
35	2	2	12	0.42989	2B12
36	2	1	2	0.68228	2A2
37	2	2	6	0.69061	2B6
38	2	1	7	0.74059	2A7
39	2	2	10	0.75831	2B10
40	2	1	8	0.79831	2A8
41	2	2	5	0.80550	2B5
42	2	1	1	0.82869	2A1
43	2	2	3	0.86239	2B3
44	2	2	2	0.88286	2B2
45	2	1	10	0.89441	2A10
46	2	2	8	0.90497	2B8
47	2	2	11	0.96685	2B11
48	2	2	1	0.98446	2B1

Log Book / Pages 2/5-6
File Folder 12B
Initials KLW Date 27JUL11

PROOFED BY
Initials KLW Date 27JUL11
REVIEWED BY
Initials ____ Date ____
not needed KLW 7Mar14

Pg 2 of 7

Analysis performed by M. Gaikowski SAS version 9.2 15:39 07JUL11 MM

```
*  date created  : 07Jul11 - MPG
*  Verified by:  _______ (Date:_______)                    page ____ of ____
*  Random allocation of mussels to tank.test 2.sas
*********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by M. Gaikowski SAS version ' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of mussels to experimental tanks*/
/* tank 1 to 24 = tank A1 to A12 (1-12), tank B1 to B12 (13-24)
   round = distribution rounds 1 to 2, place one aliquot of mussel per tank per round */

/******************************************************************************************
**********/

/*Mussel species: Hickory nut*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

NOTE: The data set WORK.MUSSEL has 48 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


data musseldist; set mussel;
if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
    if block = 1 and tank = 3 then tankn = ' 1A3';
     if block = 1 and tank = 4 then tankn = ' 1A4';
       if block = 1 and tank = 5 then tankn = ' 1A5';
        if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
    if block = 1 and tank = 9 then tankn = ' 1A9';
     if block = 1 and tank = 10 then tankn = '1A10';
       if block = 1 and tank = 11 then tankn = '1A11';
        if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
    if block = 2 and tank = 3 then tankn = ' 1B3';
     if block = 2 and tank = 4 then tankn = ' 1B4';
       if block = 2 and tank = 5 then tankn = ' 1B5';
        if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
    if block = 2 and tank = 9 then tankn = ' 1B9';
     if block = 2 and tank = 10 then tankn = '1B10';
       if block = 2 and tank = 11 then tankn = '1B11';
        if block = 2 and tank = 12 then tankn = '1B12'; run;
```

Log Book / Pages 215-6
File Folder KD write over KW 7mAY11 KD
Initials KW Date 27JUL11

PROOFED BY
Initials KW Date 27JUL11
REVIEW:
Initials Date: ____
Not needed kw 7mAY11

RE KW 27JUL11

Pg ~~8~~ 3 of 7

```
NOTE: There were 48 observations read from the data set WORK.MUSSEL.
NOTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.06 seconds
      cpu time            0.01 seconds


proc sort data= musseldist;
 by round x;
 run;

NOTE: There were 48 observations read from the data set WORK.MUSSELDIST.
NOTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Hickory nut to test tanks';
run;

NOTE: There were 48 observations read from the data set WORK.MUSSELDIST.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds



/*********************************************************************************************
**********/

/*Mussel species: Mucket*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

NOTE: The data set WORK.MUSSEL has 48 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


data musseldist; set mussel;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
```

Log Book / File 2|5-16
File Folder 128
Initials KW Date 27JUL11

PROOFED BY
Initials KW Date 27JUL11
REVIEWED
Initials ____ Date ____
not needed KW 3NOV14

Pg 4 of 7

```
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
    if block = 1 and tank = 11 then tankn = '2A11';
     if block = 1 and tank = 12 then tankn = '2A12';
if block = 2 and tank = 1 then tankn = ' 2B1';
 if block = 2 and tank = 2 then tankn = ' 2B2';
  if block = 2 and tank = 3 then tankn = ' 2B3';
   if block = 2 and tank = 4 then tankn = ' 2B4';
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;

NOTE: There were 48 observations read from the data set WORK.MUSSEL.
NOTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


proc sort data= musseldist;
 by round x;
run;

NOTE: There were 48 observations read from the data set WORK.MUSSELDIST.
NOTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Mucket to test tanks';
run;

NOTE: There were 48 observations read from the data set WORK.MUSSELDIST.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

Log Book / Pages 2/5-6
File Folder 128
Initials KW Date 27JUL11

PROOFED BY
Initials KW 27JUL11
REVIEW
Initials ___ Date: ___

not needed KW 7NOV14

```
/*********************************************************************
*  Study Number  : AEH-11-PSUEDO-02
*  Study Director: Jim Luoma
*  date created  : 07Jul11 - MPG  MMK
*  Verified by:  _______ (Date:_______)              page ____ of ____
*  Random allocation of mussels to tank.test 2.sas
*********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by M. Gaikowski SAS version ' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of mussels to experimental tanks*/
/* tank 1 to 24 = tank A1 to A12 (1-12), tank B1 to B12 (13-24)
   round = distribution rounds 1 to 2, place one aliquot of mussel per tank per round */

/**********************************************************************************************

/*Mussel species: Hickory nut*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;
data musseldist; set mussel;
if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankh = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12'; run;
proc sort data= musseldist;
 by round x;
 run;
proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Hickory nut to test tanks';
```

Log Book / File Folder 128 2/5-6
Initials KW Date 27JUL11

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Initials KW Date 27JUL11
REVIEWED
Initials ____ Date ____
not needed KW 7/27/11

Pg 6 of 7

```
run;

/*********************************************************************************************

/*Mussel species: Mucket*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;
data musseldist; set mussel;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
   if block = 1 and tank = 9 then tankn = ' 2A9';
    if block = 1 and tank = 10 then tankn = '2A10';
     if block = 1 and tank = 11 then tankn = '2A11';
      if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
     if block = 2 and tank = 5 then tankn = ' 2B5';
      if block = 2 and tank = 6 then tankn = ' 2B6';
 if block = 2 and tank = 7 then tankn = ' 2B7';
  if block = 2 and tank = 8 then tankn = ' 2B8';
   if block = 2 and tank = 9 then tankn = ' 2B9';
    if block = 2 and tank = 10 then tankn = '2B10';
     if block = 2 and tank = 11 then tankn = '2B11';
      if block = 2 and tank = 12 then tankn = '2B12';
    run;
proc sort data= musseldist;
 by round x;
run;
proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Mucket to test tanks';
run;
```

Log Book / Page: 2/5-6
File Folder: 12B
Initials: KW Date: 27 Jul 11

PROOFED BY
Initials: KW Date: 27 Jul 11
REVIEWED
Initials: Date:
Not needed KW 7 Nov 14

Item Number: 2

MM 07Jul11

Pg 7 of 7

AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels
Random assignment of Black sandshell to test tanks

AEH-11-PSEUDO-02

JSL 08 Dec 2011

Obs	round	block	tank	x	(1) tankn
1	1	1	8	0.08819	1A8
2	1	1	7	0.13317	1A7
3	1	2	8	0.26066	1B8
4	1	2	1	0.26783	1B1
5	1	1	10	0.27090	1A10
6	1	2	4	0.27969	1B4
7	1	1	9	0.38706	1A9
8	1	1	12	0.38986	1A12
9	1	2	12	0.41670	1B12
10	1	2	2	0.42899	1B2
11	1	1	2	0.46989	1A2
12	1	1	5	0.49699	1A5
13	1	1	4	0.53649	1A4
14	1	1	1	0.55111	1A1
15	1	1	11	0.62407	1A11
16	1	2	11	0.63204	1B11
17	1	2	7	0.64692	1B7
18	1	1	6	0.67828	1A6
19	1	2	6	0.68682	1B6
20	1	2	9	0.79520	1B9
21	1	2	10	0.81684	1B10
22	1	2	3	0.83026	1B3
23	1	2	5	0.89373	1B5
24	1	1	3	0.99392	1A3
25	2	2	5	0.01817	1B5
26	2	1	2	0.05008	1A2
27	2	2	8	0.10063	1B8
28	2	2	2	0.16062	1B2
29	2	1	12	0.17017	1A12
30	2	2	6	0.24261	1B6
31	2	1	1	0.24885	1A1
32	2	2	10	0.25574	1B10
33	2	1	11	0.25791	1A11
34	2	1	8	0.40757	1A8
35	2	1	4	0.41288	1A4
36	2	2	9	0.41439	1B9
37	2	2	7	0.45274	1B7
38	2	1	10	0.45628	1A10
39	2	1	6	0.46110	1A6
40	2	2	1	0.63965	1B1
41	2	1	3	0.74429	1A3
42	2	1	7	0.75054	1A7
43	2	1	5	0.75628	1A5
44	2	2	4	0.76253	1B4
45	2	2	3	0.82121	1B3
46	2	2	11	0.84577	1B11
47	2	1	9	0.94941	1A9

(1) Tank #'s were not correctly identified. The tank #'s should start with 3 not 1, otherwise they are correct 12-12-11 JSL

Log Book / Pages 2/25,26
File Folder 12B
Initials KLW Date 14 DEC 11

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed KLW
Item Number: 3

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48	2	2	12	0.96946	1B12

JTL
08DEC2011

AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels
Random assignment of empty to test tanks

Log Book / Pages 2/25,26
File Folder 12 b
Initials KW Date 7nov14

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____

not needed
KW
7nov14

Obs	round	block	tank	x	tankn
1	1	1	4	0.00916	2A4
2	1	1	9	0.02553	2A9
3	1	2	9	0.03093	2B9
4	1	1	1	0.03267	2A1
5	1	2	6	0.07213	2B6
6	1	2	3	0.07288	2B3
7	1	1	8	0.11013	2A8
8	1	1	5	0.13931	2A5
9	1	1	7	0.17545	2A7
10	1	1	12	0.21888	2A12
11	1	2	1	0.33305	2B1
12	1	2	5	0.40190	2B5
13	1	1	3	0.47870	2A3
14	1	2	4	0.51232	2B4
15	1	1	10	0.52675	2A10
16	1	2	7	0.54399	2B7
17	1	1	11	0.56970	2A11
18	1	2	10	0.62027	2B10
19	1	2	12	0.62410	2B12
20	1	2	11	0.71863	2B11
21	1	1	6	0.74915	2A6
22	1	2	2	0.77920	2B2
23	1	1	2	0.80916	2A2
24	1	2	8	0.96740	2B8
25	2	1	3	0.01142	2A3
26	2	1	9	0.02725	2A9
27	2	2	4	0.06752	2B4
28	2	2	6	0.10196	2B6
29	2	1	12	0.11772	2A12
30	2	2	11	0.13761	2B11
31	2	1	8	0.13934	2A8
32	2	2	3	0.24154	2B3
33	2	2	12	0.26603	2B12
34	2	1	11	0.32967	2A11
35	2	1	5	0.41977	2A5
36	2	2	8	0.42640	2B8
37	2	1	1	0.44353	2A1
38	2	2	5	0.47186	2B5
39	2	2	2	0.50313	2B2
40	2	2	1	0.62839	2B1
41	2	2	7	0.66888	2B7

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not used
12-12-11
JTL

42	2	2	9	0.67250	2B9
43	2	1	4	0.69179	2A4
44	2	1	6	0.71780	2A6
45	2	1	7	0.73718	2A7
46	2	1	10	0.74096	2A10
47	2	1	2	0.82592	2A2
48	2	2	10	0.90172	2B10

JAL

AEH-11-PSEUDO-02

Log Book / Pages 2/25-26
File Folder 12 B
Initials JW Date 3Nov11

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Initials: ____ Date: ____
REVIEWED BY
Initials ____ Date ____
not needed per instruction

Analysis performed by James Luoma SAS version 9.2 10:21 08DEC11

AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels
Random assignment of ~~Higgins eye~~ Washboard ① to test tanks

Obs	round	block	tank	x	tankn ②
1	1	1	12	0.04789	3A12 Transfer 1
2	1	2	2	0.12942	3B2
3	1	1	8	0.13208	3A8
4	1	1	2	0.14843	3A2
5	1	1	7	0.21772	3A7
6	1	2	9	0.26666	3B9
7	1	2	3	0.31549	3B3
8	1	2	1	0.39827	3B1
9	1	2	10	0.42371	3B10
10	1	2	7	0.44106	3B7
11	1	2	6	0.45744	3B6
12	1	1	4	0.48182	3A4
13	1	1	1	0.51423	3A1
14	1	1	11	0.51534	3A11
15	1	1	9	0.66399	3A9
16	1	2	8	0.67415	3B8
17	1	2	4	0.74495	3B4
18	1	1	5	0.78163	3A5
19	1	1	10	0.78260	3A10
20	1	2	11	0.80523	3B11
21	1	1	6	0.82003	3A6
22	1	2	12	0.83151	3B12
23	1	2	5	0.91007	3B5
24	1	1	3	0.96347	3A3
25	2	1	10	0.02564	3A10 Transfer 2
26	2	1	12	0.06528	3A12
27	2	1	5	0.08325	3A5
28	2	1	9	0.10508	3A9
29	2	1	3	0.27856	3A3
30	2	2	4	0.37252	3B4
31	2	1	11	0.40144	3A11
32	2	2	11	0.42944	3B11
33	2	2	10	0.54770	3B10
34	2	2	12	0.56260	3B12
35	2	1	2	0.60176	3A2

① Species was not correctly changed to reflect Washboard juveniles. Randomization is correct, species should be Washboard not Higgins eye.
12-8-11 JAL

② Tank # was not correctly identified the actual tank #'s should start with a 2 not a 3, otherwise they are correct
12-12-11 JAL

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36	2	2	1	0.61713	[redacted]
37	2	1	1	0.63820	[redacted]
38	2	2	3	0.66187	[redacted]
39	2	1	7	0.72381	[redacted]
40	2	2	8	0.75218	[redacted]
41	2	2	2	0.84564	[redacted]
42	2	1	8	0.87111	[redacted]
43	2	2	7	0.88503	[redacted]
44	2	2	5	0.92554	[redacted]
45	2	2	9	0.93060	[redacted]
46	2	2	6	0.96131	[redacted]
47	2	1	4	0.97070	[redacted]
48	2	1	6	0.97450	[redacted]

Transfer 3

Jm

Log Book / Pages 2/25-26
File Folder 12B
Initials KW Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
Not needed KW 7Nov14

AEH-11-PSEUDO-02

Analysis performed by James Luoma SAS version 9.2 10:21 08DEC11

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```
/*********************************************************************
*  Study Number   : AEH-11-PSUEDO-02
*  Study Director: Jim Luoma                 AEH-11-PSEUDO-02
*  date created   : 08Dec11 - JAL
*  Verified by:  _______ (Date:_______)                 page ____ of ____
*  Random allocation of glochidia to tank.sas
*********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;
                                                    JAL 08DEC 2011
FOOTNOTE1 'Analysis performed by James Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of mussels to experimental tanks*/
/* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
   round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

/*************************************************************************************************

/*Mussel species: Black sandshell*/
data juvenile;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;
data juveniledist; set juvenile;
if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12'; run;
```

Log Book / Pages 2/25-26
File Folder 12B
Initials JM Date 7Nov14

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed JMW 7Nov14

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```
proc sort data= juveniledist;
 by round x;
 run;
proc print data = juveniledist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Black sandshell to test tanks';
run;
```

Jr

AEH-11-PSEUDO-02

```
/*******************************************************************************************

/*Mussel species: washboard*/
data juvenile;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;
data juveniledist; set juvenile;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
   if block = 1 and tank = 9 then tankn = ' 2A9';
    if block = 1 and tank = 10 then tankn = '2A10';
     if block = 1 and tank = 11 then tankn = '2A11';
      if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
     if block = 2 and tank = 5 then tankn = ' 2B5';
      if block = 2 and tank = 6 then tankn = ' 2B6';
 if block = 2 and tank = 7 then tankn = ' 2B7';
  if block = 2 and tank = 8 then tankn = ' 2B8';
   if block = 2 and tank = 9 then tankn = ' 2B9';
    if block = 2 and tank = 10 then tankn = '2B10';
     if block = 2 and tank = 11 then tankn = '2B11';
      if block = 2 and tank = 12 then tankn = '2B12';
    run;
proc sort data= juveniledist;
 by round x;
run;
proc print data = juveniledist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of empty to test tanks';
run;
```

Log Book / Pages 2/25-26
File Folder 12.B
Initials KW Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED B
Initials: ____ Date: ____

not needed KW 7Nov14

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```
/*************************************************************************************************

/*Mussel species: Higgins eye*/
data glochidia;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;
data glochidiadist; set glochidia;
 if block = 1 and tank = 1 then tankn = ' 3A1';
  if block = 1 and tank = 2 then tankn = ' 3A2';
   if block = 1 and tank = 3 then tankn = ' 3A3';
    if block = 1 and tank = 4 then tankn = ' 3A4';
     if block = 1 and tank = 5 then tankn = ' 3A5';
      if block = 1 and tank = 6 then tankn = ' 3A6';
if block = 1 and tank = 7 then tankn = ' 3A7';
  if block = 1 and tank = 8 then tankn = ' 3A8';
   if block = 1 and tank = 9 then tankn = ' 3A9';
    if block = 1 and tank = 10 then tankn = '3A10';
     if block = 1 and tank = 11 then tankn = '3A11';
      if block = 1 and tank = 12 then tankn = '3A12';
 if block = 2 and tank = 1 then tankn = ' 3B1';
  if block = 2 and tank = 2 then tankn = ' 3B2';
   if block = 2 and tank = 3 then tankn = ' 3B3';
    if block = 2 and tank = 4 then tankn = ' 3B4';
     if block = 2 and tank = 5 then tankn = ' 3B5';
      if block = 2 and tank = 6 then tankn = ' 3B6';
 if block = 2 and tank = 7 then tankn = ' 3B7';
  if block = 2 and tank = 8 then tankn = ' 3B8';
   if block = 2 and tank = 9 then tankn = ' 3B9';
    if block = 2 and tank = 10 then tankn = '3B10';
     if block = 2 and tank = 11 then tankn = '3B11';
      if block = 2 and tank = 12 then tankn = '3B12';
    run;
proc sort data= glochidiadist;
 by round x;
run;
proc print data = glochidiadist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Higgins eye to test tanks';
run;
```

AEH-11-PSEUDO-02

Log Book / Pages 2/25-26
File Folder 12 B
Initials VW Date 7Nov14

PROOFED BY
Initials: ____ Date ____
REVIEWED BY
Initials: ____ Date: ____

not needed vw 7Nov14

Item Number: 3

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EH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels andom assignment of Fatmucket to test tanks JAL 1-23-2012 1

bs	round	block	tank	x	tankn
1	1	2	11	0.05229	1B11
2	1	1	5	0.05350	1A5
3	1	2	1	0.14661	1B1
4	1	1	11	0.14803	1A11
5	1	1	7	0.15462	1A7
6	1	2	9	0.17454	1B9
7	1	1	2	0.18201	1A2
8	1	1	9	0.18203	1A9
9	1	1	3	0.22977	1A3
10	1	2	6	0.26974	1B6
11	1	1	12	0.32757	1A12
12	1	2	8	0.35430	1B8
13	1	2	2	0.39890	1B2
14	1	1	1	0.43493	1A1
15	1	2	5	0.44058	1B5
16	1	2	10	0.45628	1B10
17	1	2	3	0.49841	1B3
18	1	1	6	0.54042	1A6
19	1	1	10	0.67251	1A10
20	1	2	12	0.75495	1B12
21	1	1	8	0.78721	1A8
22	1	1	4	0.91774	1A4
23	1	2	4	0.96298	1B4
24	1	2	7	0.97875	1B7
25	2	1	7	0.00407	1A7
26	2	1	3	0.02105	1A3
27	2	2	3	0.08274	1B3
28	2	2	10	0.14936	1B10
29	2	1	2	0.16474	1A2
30	2	2	5	0.24048	1B5
31	2	2	11	0.25486	1B11
32	2	1	8	0.25825	1A8
33	2	2	7	0.30713	1B7
34	2	2	2	0.35824	1B2
35	2	1	4	0.38299	1A4
36	2	2	4	0.41243	1B4
37	2	2	6	0.44335	1B6
38	2	1	6	0.46827	1A6
39	2	1	10	0.54627	1A10
40	2	1	5	0.57075	1A5
41	2	2	9	0.61120	1B9
42	2	1	1	0.61430	1A1
43	2	2	8	0.61480	1B8
44	2	2	1	0.61785	1B1
45	2	1	12	0.62333	1A12
46	2	2	12	0.68431	1B12
47	2	1	11	0.91339	1A11
48	2	1	9	0.98465	1A9

Initiated at ~~1142~~ 1152 JKW 26JAN12 pisentry

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AEH-11-PSEUDO-02

Item Number: 4

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Distribution completed at 1339 JKW 26JAN12

EH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels 2
andom assignment of empty to test tanks

AEH-11-PSEUDO-02

bs	round	block	tank	x	tankn
1	1	1	2	0.02165	2A2
2	1	1	9	0.05011	2A9
3	1	1	10	0.05456	2A10
4	1	1	5	0.05564	2A5
5	1	2	9	0.07639	2B9
6	1	1	4	0.10642	2A4
7	1	1	12	0.12892	2A12
8	1	2	2	0.19288	2B2
9	1	2	3	0.22020	2B3
10	1	2	4	0.22139	2B4
11	1	2	6	0.29216	2B6
12	1	2	7	0.29729	2B7
13	1	2	11	0.49387	2B11
14	1	2	8	0.52719	2B8
15	1	1	1	0.59582	2A1
16	1	2	10	0.61942	2B10
17	1	2	1	0.65911	2B1
18	1	1	8	0.69597	2A8
19	1	1	6	0.80698	2A6
20	1	1	3	0.82152	2A3
21	1	1	11	0.84504	2A11
22	1	2	5	0.87967	2B5
23	1	1	7	0.90563	2A7
24	1	2	12	0.95022	2B12
25	2	2	9	0.06083	2B9
26	2	2	3	0.09946	2B3
27	2	1	2	0.13315	2A2
28	2	2	4	0.19519	2B4
29	2	2	1	0.23746	2B1
30	2	1	4	0.27140	2A4
31	2	1	10	0.27404	2A10
32	2	1	5	0.28887	2A5
33	2	1	9	0.30532	2A9
34	2	2	2	0.30964	2B2
35	2	2	5	0.31255	2B5
36	2	2	10	0.37035	2B10
37	2	2	11	0.37749	2B11
38	2	1	12	0.38735	2A12
39	2	1	7	0.40742	2A7
40	2	1	8	0.40885	2A8
41	2	2	12	0.45308	2B12
42	2	2	7	0.47435	2B7
43	2	1	6	0.55386	2A6

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45	2	1	1	0.74589	2A1
46	2	1	3	0.78353	2A3
47	2	2	6	0.80568	2B6
48	2	1	11	0.92611	2A11

Log book / Pages 2/32
File Folder 12 E
Initials KW Date 7 Nov 14

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REVIEWED
Initials: ______ Date ______

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nalysis performed by J. Luoma SAS version 9.2 08:55 23JAN12 JA

EH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels
andom assignment of empty to test tanks

AEH-11-PSEUDO-02

bs	round	block	tank	x	tankn
1	1	1	5	0.05779	3A5
2	1	1	6	0.07354	3A6
3	1	2	12	0.14549	3B12
4	1	2	1	0.17160	3B1
5	1	1	4	0.29510	3A4
6	1	2	6	0.31459	3B6
7	1	2	5	0.31877	3B5
8	1	1	3	0.41327	3A3
9	1	1	10	0.43661	3A10
10	1	2	4	0.47980	3B4
11	1	1	11	0.54205	3A11
12	1	1	8	0.60473	3A8
13	1	2	7	0.61583	3B7
14	1	1	7	0.65664	3A7
15	1	2	8	0.70008	3B8
16	1	1	1	0.75672	3A1
17	1	2	10	0.78257	3B10
18	1	1	2	0.86129	3A2
19	1	1	9	0.91820	3A9
20	1	1	12	0.93027	3A12
21	1	2	11	0.93545	3B11
22	1	2	3	0.94199	3B3
23	1	2	9	0.97823	3B9
24	1	2	2	0.98686	3B2
25	2	1	10	0.00180	3A10
26	2	1	5	0.00699	3A5
27	2	1	2	0.10156	3A2
28	2	2	3	0.11618	3B3
29	2	1	12	0.15138	3A12
30	2	1	4	0.15980	3A4
31	2	2	6	0.16800	3B6
32	2	2	12	0.22186	3B12
33	2	2	2	0.26103	3B2
34	2	2	5	0.38462	3B5
35	2	2	11	0.50011	3B11
36	2	2	9	0.51045	3B9
37	2	1	3	0.54600	3A3
38	2	1	8	0.55944	3A8

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39	2	2	10	0.59134	3B10
40	2	1	9	0.62598	3A9
41	2	1	6	0.63945	3A6
42	2	2	7	0.64157	3B7
43	2	1	7	0.81076	3A7
44	2	2	8	0.84502	3B8
45	2	2	1	0.85707	3B1
46	2	1	1	0.87747	3A1
47	2	1	11	0.93883	3A11
48	2	2	4	0.97794	3B4

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File Folder 12B
Initials KW Date 7Nov14

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AEH-11-PSEUDO-02

nalysis performed by J. Luoma SAS version 9.2 08:55 23JAN12 JRL

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```
  Study Number  : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created  : 23 JAN 2012 - JAL
  Verified by:  _______ (Date:_______)                       page ____ of ____
  Random allocation of mussels to tank.sas
*******************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

*Random distribution of mussels to experimental tanks*/
* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
  round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

*******************************************************************************************************

*Mussel species: Fatmucket*/
ata glochidia;
do round = 1 to 2 by 1;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
 end;
end;
un;
ata glochidiadist; set glochidia;
f block = 1 and tank = 1 then tankn = ' 1A1';
 if block = 1 and tank = 2 then tankn = ' 1A2';
  if block = 1 and tank = 3 then tankn = ' 1A3';
   if block = 1 and tank = 4 then tankn = ' 1A4';
    if block = 1 and tank = 5 then tankn = ' 1A5';
     if block = 1 and tank = 6 then tankn = ' 1A6';
f block = 1 and tank = 7 then tankn = ' 1A7';
 if block = 1 and tank = 8 then tankn = ' 1A8';
  if block = 1 and tank = 9 then tankn = ' 1A9';
   if block = 1 and tank = 10 then tankn = '1A10';
    if block = 1 and tank = 11 then tankn = '1A11';
     if block = 1 and tank = 12 then tankn = '1A12';
if block = 2 and tank = 1 then tankn = ' 1B1';
 if block = 2 and tank = 2 then tankn = ' 1B2';
  if block = 2 and tank = 3 then tankn = ' 1B3';
   if block = 2 and tank = 4 then tankn = ' 1B4';
    if block = 2 and tank = 5 then tankn = ' 1B5';
     if block = 2 and tank = 6 then tankn = ' 1B6';
if block = 2 and tank = 7 then tankn = ' 1B7';
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12'; run;
roc sort data= glochidiadist;
```


Log Book / Pages 2/32
File Folder 12 8
Initials JMW Date 7nov14

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REVIEWED BY
Initials: ____ Date: ____
not needed JMW 7nov14

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```
by round x;
run;
roc print data = glochidiadist;
itle1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
itle2 h=1 'Random assignment of Fatmucket to test tanks';
un;

*******************************************************************************************************

*Mussel species: empty*/
ata glochidia;
do round = 1 to 2 by 1;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
 end;
end;
un;
ata glochidiadist; set glochidia;
if block = 1 and tank = 1 then tankn = ' 2A1';
 if block = 1 and tank = 2 then tankn = ' 2A2';
  if block = 1 and tank = 3 then tankn = ' 2A3';
   if block = 1 and tank = 4 then tankn = ' 2A4';
    if block = 1 and tank = 5 then tankn = ' 2A5';
     if block = 1 and tank = 6 then tankn = ' 2A6';
f block = 1 and tank = 7 then tankn = ' 2A7';
 if block = 1 and tank = 8 then tankn = ' 2A8';
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
    if block = 1 and tank = 11 then tankn = '2A11';
     if block = 1 and tank = 12 then tankn = '2A12';
if block = 2 and tank = 1 then tankn = ' 2B1';
 if block = 2 and tank = 2 then tankn = ' 2B2';
  if block = 2 and tank = 3 then tankn = ' 2B3';
   if block = 2 and tank = 4 then tankn = ' 2B4';
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;
roc sort data= glochidiadist;
by round x;
un;
roc print data = glochidiadist;
itle1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
itle2 h=1 'Random assignment of empty to test tanks';
un;

*******************************************************************************************************
```

AEH-11-PSEUDO-02

Log Book / Pages 2/32
File Folder 12B
Initials [illegible] Date 7 nov14

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[illegible] 7 nov14

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```
ata glochidia;
do round = 1 to 2 by 1;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
 end;
end;
un;
ata glochidiadist; set glochidia;
if block = 1 and tank = 1 then tankn = ' 3A1';
 if block = 1 and tank = 2 then tankn = ' 3A2';
  if block = 1 and tank = 3 then tankn = ' 3A3';
   if block = 1 and tank = 4 then tankn = ' 3A4';
    if block = 1 and tank = 5 then tankn = ' 3A5';
     if block = 1 and tank = 6 then tankn = ' 3A6';
f block = 1 and tank = 7 then tankn = ' 3A7';
 if block = 1 and tank = 8 then tankn = ' 3A8';
  if block = 1 and tank = 9 then tankn = ' 3A9';
   if block = 1 and tank = 10 then tankn = '3A10';
    if block = 1 and tank = 11 then tankn = '3A11';
     if block = 1 and tank = 12 then tankn = '3A12';
if block = 2 and tank = 1 then tankn = ' 3B1';
 if block = 2 and tank = 2 then tankn = ' 3B2';
  if block = 2 and tank = 3 then tankn = ' 3B3';
   if block = 2 and tank = 4 then tankn = ' 3B4';
    if block = 2 and tank = 5 then tankn = ' 3B5';
     if block = 2 and tank = 6 then tankn = ' 3B6';
if block = 2 and tank = 7 then tankn = ' 3B7';
 if block = 2 and tank = 8 then tankn = ' 3B8';
  if block = 2 and tank = 9 then tankn = ' 3B9';
   if block = 2 and tank = 10 then tankn = '3B10';
    if block = 2 and tank = 11 then tankn = '3B11';
     if block = 2 and tank = 12 then tankn = '3B12';
   run;
roc sort data= glochidiadist;
by round x;
un;
roc print data = glochidiadist;
itle1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
itle2 h=1 'Random assignment of empty to test tanks';
un;
```

AEH-11-PSEUDO-02

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Initials Nw Date 7 nov 14

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```
   date created  : 20 JAN 2012 - JAL
*  Verified by:  _______ (Date:_______)                   page ____ of ____
*  Random allocation of mussels to tank.sas
*****************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of mussels to experimental tanks*/
/* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
   round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

/*****************************************************************************************
**********/

/*Mussel species: Fatmucket*/
data glochidia;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

OTE: The data set WORK.GLOCHIDIA has 48 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data glochidiadist; set glochidia;
if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
```

AEH-11-PSEUDO-02

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```
if block = 2 and tank = 8 then tankn = ' 1B8';
 if block = 2 and tank = 9 then tankn = ' 1B9';
  if block = 2 and tank = 10 then tankn = '1B10';
   if block = 2 and tank = 11 then tankn = '1B11';
    if block = 2 and tank = 12 then tankn = '1B12'; run;
```

Log Book / Pages 2/52
File Folder 12B
Initials kw Date 7nov14

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Initials: ____ Date: ____
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KW 7nov14

```
OTE: There were 48 observations read from the data set WORK.GLOCHIDIA.
OTE: The data set WORK.GLOCHIDIADIST has 48 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds
```

AEH-11-PSEUDO-02

```
proc sort data= glochidiadist;
 by round x;
 run;

OTE: There were 48 observations read from the data set WORK.GLOCHIDIADIST.
OTE: The data set WORK.GLOCHIDIADIST has 48 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


proc print data = glochidiadist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Fatmucket to test tanks';
run;

OTE: There were 48 observations read from the data set WORK.GLOCHIDIADIST.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


/*****************************************************************************************
**********/

/*Mussel species: empty*/
data glochidia;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

OTE: The data set WORK.GLOCHIDIA has 48 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

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```
data glochidiadist; set glochidia;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
   if block = 1 and tank = 9 then tankn = ' 2A9';
    if block = 1 and tank = 10 then tankn = '2A10';
     if block = 1 and tank = 11 then tankn = '2A11';
      if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
     if block = 2 and tank = 5 then tankn = ' 2B5';
      if block = 2 and tank = 6 then tankn = ' 2B6';
 if block = 2 and tank = 7 then tankn = ' 2B7';
  if block = 2 and tank = 8 then tankn = ' 2B8';
   if block = 2 and tank = 9 then tankn = ' 2B9';
    if block = 2 and tank = 10 then tankn = '2B10';
     if block = 2 and tank = 11 then tankn = '2B11';
      if block = 2 and tank = 12 then tankn = '2B12';
    run;
```

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File Folder 12B
Initials KW Date 7 Nov 14

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REVIEWED BY
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not needed first 7 Nov 14

AEH-11-PSEUDO-02

```
OTE: There were 48 observations read from the data set WORK.GLOCHIDIA.
OTE: The data set WORK.GLOCHIDIADIST has 48 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds


proc sort data= glochidiadist;
 by round x;
run;

OTE: There were 48 observations read from the data set WORK.GLOCHIDIADIST.
OTE: The data set WORK.GLOCHIDIADIST has 48 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

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```
proc print data = glochidiadist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of empty to test tanks';
run;

OTE: There were 48 observations read from the data set WORK.GLOCHIDIADIST.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds
```

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AEH-11-PSEUDO-02

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Initials: Date:
not needed
kw 7Nov14

```
/******************************************************************************************
**********/

/*Mussel species: empty*/
data glochidia;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

DTE: The data set WORK.GLOCHIDIA has 48 observations and 4 variables.
DTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data glochidiadist; set glochidia;
 if block = 1 and tank = 1 then tankn = ' 3A1';
  if block = 1 and tank = 2 then tankn = ' 3A2';
   if block = 1 and tank = 3 then tankn = ' 3A3';
    if block = 1 and tank = 4 then tankn = ' 3A4';
     if block = 1 and tank = 5 then tankn = ' 3A5';
      if block = 1 and tank = 6 then tankn = ' 3A6';
if block = 1 and tank = 7 then tankn = ' 3A7';
  if block = 1 and tank = 8 then tankn = ' 3A8';
   if block = 1 and tank = 9 then tankn = ' 3A9';
    if block = 1 and tank = 10 then tankn = '3A10';
     if block = 1 and tank = 11 then tankn = '3A11';
      if block = 1 and tank = 12 then tankn = '3A12';
 if block = 2 and tank = 1 then tankn = ' 3B1';
  if block = 2 and tank = 2 then tankn = ' 3B2';
   if block = 2 and tank = 3 then tankn = ' 3B3';
    if block = 2 and tank = 4 then tankn = ' 3B4';
     if block = 2 and tank = 5 then tankn = ' 3B5';
      if block = 2 and tank = 6 then tankn = ' 3B6';
 if block = 2 and tank = 7 then tankn = ' 3B7';
  if block = 2 and tank = 8 then tankn = ' 3B8';
   if block = 2 and tank = 9 then tankn = ' 3B9';
    if block = 2 and tank = 10 then tankn = '3B10';
     if block = 2 and tank = 11 then tankn = '3B11';
      if block = 2 and tank = 12 then tankn = '3B12';
    run;

DTE: There were 48 observations read from the data set WORK.GLOCHIDIA.
DTE: The data set WORK.GLOCHIDIADIST has 48 observations and 5 variables.
DTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds
```

Page 12 of 13

```
proc sort data= glochidiadist;
 by round x;
run;

OTE: There were 48 observations read from the data set WORK.GLOCHIDIADIST.
OTE: The data set WORK.GLOCHIDIADIST has 48 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds
```

AEH-11-PSEUDO-02

```
proc print data = glochidiadist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of empty to test tanks';
run;

OTE: There were 48 observations read from the data set WORK.GLOCHIDIADIST.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds
```

Log Book / Pages 2/32
File Folder 12B
Initials KW Date 7Nov14

PROOFED BY
Initials: Date:
REVIEWED
Initials: Date:

not needed KW 7nov14

Item Number: 4

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EH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels
andom assignment of Black sandshell to test tanks

3/28/12
JA

AEH-11-PSEUDO-02

bs	round	block	tank	x	tankn
1	1	1	9	0.04158	2A9
2	1	2	1	0.06698	2B1
3	1	2	3	0.09349	2B3
4	1	2	12	0.09652	2B12
5	1	2	10	0.17358	2B10
6	1	1	11	0.17971	2A11
7	1	1	5	0.26713	2A5
8	1	2	5	0.30466	2B5
9	1	1	4	0.35557	2A4
10	1	1	10	0.42195	2A10
11	1	2	4	0.49442	2B4
12	1	2	9	0.54311	2B9
13	1	2	7	0.56173	2B7
14	1	1	2	0.57738	2A2
15	1	1	6	0.58710	2A6
16	1	1	12	0.75776	2A12
17	1	1	8	0.76146	2A8
18	1	2	2	0.79612	2B2
19	1	2	6	0.81999	2B6
20	1	1	1	0.82296	2A1
21	1	1	3	0.82826	2A3
22	1	2	8	0.85686	2B8
23	1	2	11	0.87090	2B11
24	1	1	7	0.89267	2A7
25	2	2	5	0.00486	2B5
26	2	2	12	0.01782	2B12
27	2	1	7	0.04565	2A7
28	2	2	7	0.09234	2B7
29	2	2	9	0.13769	2B9
30	2	2	6	0.17562	2B6
31	2	1	10	0.20670	2A10
32	2	1	12	0.26008	2A12
33	2	2	11	0.30709	2B11
34	2	1	2	0.33732	2A2
35	2	1	9	0.44648	2A9
36	2	1	1	0.48938	2A1
37	2	1	11	0.53360	2A11
38	2	1	4	0.57842	2A4
39	2	2	3	0.67185	2B3
40	2	2	10	0.67357	2B10
41	2	2	1	0.77314	2B1
42	2	1	8	0.79665	2A8
43	2	1	6	0.79956	2A6
44	2	1	3	0.83320	2A3
45	2	2	4	0.86492	2B4
46	2	2	8	0.91040	2B8
47	2	2	2	0.93700	2B2
48	2	1	5	0.99319	2A5

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1409

Log Book 7 Pages 2/39-40
File Folder 12b
Initials [illegible] Date DAPPED

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Initials:
REVIEWED
Initials: Date
not needed
hw 7/11/14

Item Number: 5

Page 1 of 6

nalysis performed by J. Luoma SAS version 9.2 08:45 28MAR12

Log Book / Pages 2/39-40
File Folder 12.B
Initials KW Date 7nov14

AEH-11-PSEUDO-02

Not needed KW 7nov14

Page 2 of 6

```
* Verified by: _______ (Date:_______)                     page ____ of ____
* Random allocation of mussel to exposure chambers.sas
**********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of Mussels to experimental tanks*/
/* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
   round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

/**********************************************************************************************
**********/

/*Mussel species: Black sandshell*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

OTE: The data set WORK.MUSSEL has 48 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data musseldist; set mussel;
if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
   if block = 1 and tank = 9 then tankn = ' 2A9';
    if block = 1 and tank = 10 then tankn = '2A10';
     if block = 1 and tank = 11 then tankn = '2A11';
      if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
     if block = 2 and tank = 5 then tankn = ' 2B5';
      if block = 2 and tank = 6 then tankn = ' 2B6';
 if block = 2 and tank = 7 then tankn = ' 2B7';
```

AEH-11-PSEUDO-02

Log Book / Pages 2/39-40
File Folder 12 B
Initials JW Date 7Nov14

PROOFED BY
Initials: ____ Date ____
REVIEWED
Initials: ____ Date: ____
not needed
JW 7Nov14

Page 3 of 6

```
if block = 2 and tank = 8 then tankn = ' 2B8';
 if block = 2 and tank = 9 then tankn = ' 2B9';
  if block = 2 and tank = 10 then tankn = '2B10';
   if block = 2 and tank = 11 then tankn = '2B11';
    if block = 2 and tank = 12 then tankn = '2B12'; run;

OTE: There were 48 observations read from the data set WORK.MUSSEL.
OTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds
```

Log Book / Pages 2/39-40
File Folder 12B
Initials fnw Date 7nov14

PROOFED BY
Initials: Date
REVIEWED BY
Initials: Date
not needed
fnw 7nov14

AEH-11-PSEUDO-02

```
proc sort data= musseldist;
 by round x;
 run;

OTE: There were 48 observations read from the data set WORK.MUSSELDIST.
OTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds

proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Black sandshell to test tanks';
run;

OTE: There were 48 observations read from the data set WORK.MUSSELDIST.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

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```
  Study Number  : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created  : 28Mar12 - JAL
  Verified by:  _______ (Date:_______)                   page ____ of ____
  Random allocation of mussel to exposure chambers.sas
*****************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;
```

AEH-11-PSEUDO-02

```
OOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

*Random distribution of Mussels to experimental tanks*/
* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
  round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

**********************************************************************************************

*Mussel species: Black sandshell*/
ata mussel;
do round = 1 to 2 by 1;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
 end;
end;
un;
ata musseldist; set mussel;
f block = 1 and tank = 1 then tankn = ' 2A1';
 if block = 1 and tank = 2 then tankn = ' 2A2';
  if block = 1 and tank = 3 then tankn = ' 2A3';
   if block = 1 and tank = 4 then tankn = ' 2A4';
    if block = 1 and tank = 5 then tankn = ' 2A5';
     if block = 1 and tank = 6 then tankn = ' 2A6';
f block = 1 and tank = 7 then tankn = ' 2A7';
 if block = 1 and tank = 8 then tankn = ' 2A8';
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
    if block = 1 and tank = 11 then tankn = '2A11';
     if block = 1 and tank = 12 then tankn = '2A12';
if block = 2 and tank = 1 then tankn = ' 2B1';
 if block = 2 and tank = 2 then tankn = ' 2B2';
  if block = 2 and tank = 3 then tankn = ' 2B3';
   if block = 2 and tank = 4 then tankn = ' 2B4';
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12'; run;
roc sort data= musseldist;
```

Log Book / Pages 2/39-40
File Folder 12 B
Initials JWL Date 3Nov14

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Initials: ____ Date: ____
REVIEWED B
Initials: ____ Date: ____
not needed
JWL 7Nov14

Page 5 of 6

```
oy round x;
run;
roc print data = musseldist;
itle1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
itle2 h=1 'Random assignment of Black sandshell to test tanks';
un;
```

Log Book / Pages 2/39-40
File Folder 12B
Initials fw Date 7Nov14

AEH-11-PSEUDO-02

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Initials: ____ Date: ____
REVIEWED
Initials: ____ Date: ____
not needed
fw 7Nov14

Item Number: 5

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.EH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels 5/1/12 AEH-11-PSEUDO-02 1
.andom assignment of Plain pocketbook to test tanks

JW 12:30

Distribution initiated at JKW

Log Book / Pages 2/45
File Folder 12 B
Initials JW Date 7Nov14

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Initials: Date:
REVIEWED BY
Initials: Date:
not needed
JKW 7Nov14

bs	round	block	tank	x	tankn
1	1	1	3	0.01634	1A3
2	1	2	1	0.03207	1B1
3	1	2	3	0.04182	1B3
4	1	1	8	0.13377	1A8
5	1	2	2	0.22266	1B2
6	1	1	4	0.25000	1A4
7	1	2	10	0.28958	1B10
8	1	1	12	0.33047	1A12
9	1	2	6	0.36351	1B6
10	1	1	11	0.42768	1A11
11	1	1	10	0.45335	1A10
12	1	1	9	0.47432	1A9
13	1	1	2	0.49810	1A2
14	1	2	11	0.59294	1B11
15	1	1	5	0.63427	1A5
16	1	2	7	0.68453	1B7
17	1	2	12	0.74188	1B12
18	1	1	1	0.74579	1A1
19	1	1	6	0.77796	1A6
20	1	1	7	0.79174	1A7
21	1	2	8	0.82138	1B8
22	1	2	4	0.84963	1B4
23	1	2	9	0.85118	1B9
24	1	2	5	0.93257	1B5
25	2	2	10	0.16294	1B10
26	2	1	7	0.19780	1A7
27	2	2	7	0.21217	1B7
28	2	1	5	0.33650	1A5
29	2	1	6	0.42623	1A6
30	2	1	10	0.59381	1A10
31	2	2	8	0.62300	1B8
32	2	1	2	0.66415	1A2
33	2	1	3	0.67417	1A3
34	2	1	1	0.68734	1A1
35	2	2	4	0.69945	1B4
36	2	2	9	0.71842	1B9
37	2	1	9	0.73644	1A9
38	2	2	2	0.73743	1B2
39	2	2	6	0.77213	1B6
40	2	1	11	0.78958	1A11
41	2	2	11	0.83529	1B11
42	2	2	3	0.85147	1B3
43	2	2	5	0.86661	1B5
44	2	1	8	0.87796	1A8
45	2	2	1	0.89901	1B1
46	2	1	4	0.90528	1A4
47	2	2	12	0.92613	1B12
48	2	1	12	0.99655	1A12

Item Number: 6

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Completed Distribution at 1410h JKW

nalysis performed by J. Luoma SAS version 9.2 14:35 02MAY12

Log Book / Pages 2/45
File Folder 12 B
Initials KW Date 7Nov14

AEH-11-PSEUDO-02

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Initials: _____ Date : _____
REVIEWED BY
Initials: _____ Date: _____
not needed
KW 7Nov14

Page 2 of 6

```
*    date created  : 02May12 - JAL
*    Verified by:  _______  (Date: ________)                          page ____ of ____
*    Random allocation of mussel to exposure chambers.sas
***********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of Mussels to experimental tanks*/
/* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
   round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

/*********************************************************************************************
**********/

/*Mussel species: Plain Pocketbook*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

NOTE: The data set WORK.MUSSEL has 48 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


data musseldist; set mussel;
if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
```

AEH-11-PSEUDO-02

Log Book / Pages 2/45
File Folder 12B
Initials LW Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed
LW 7Nov14

Page 3 of 6

```
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12'; run;

OTE: There were 48 observations read from the data set WORK.MUSSEL.
OTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.01 seconds
```

Log Book / Pages 2/45
File Folder 12 B
Initials MJ Date 7nov14

AEH-11-PSEUDO-02

PROOFED BY
Initials: Date :
REVIEWED BY
Initials: Date:
not needed
MW 7nov14

```
proc sort data= musseldist;
 by round x;
 run;

OTE: There were 48 observations read from the data set WORK.MUSSELDIST.
OTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.00 seconds

proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Plain pocketbook to test tanks';
run;

OTE: There were 48 observations read from the data set WORK.MUSSELDIST.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds
```

Page 4 of 6

```
  Study Number  : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created  : 02May12 - JAL
  Verified by:  _______ (Date:_______)                page ____ of ____
  Random allocation of mussel to exposure chambers.sas
******************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

*Random distribution of Mussels to experimental tanks*/
* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
  round = distribution rounds 1 to 2, place one aliquot of glochidia per tank per round */

****************************************************************************************************

*Mussel species: Plain Pocketbook*/
ata mussel;
do round = 1 to 2 by 1;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
 end;
end;
un;
ata musseldist; set mussel;
f block = 1 and tank = 1 then tankn = ' 1A1';
 if block = 1 and tank = 2 then tankn = ' 1A2';
  if block = 1 and tank = 3 then tankn = ' 1A3';
   if block = 1 and tank = 4 then tankn = ' 1A4';
    if block = 1 and tank = 5 then tankn = ' 1A5';
     if block = 1 and tank = 6 then tankn = ' 1A6';
f block = 1 and tank = 7 then tankn = ' 1A7';
 if block = 1 and tank = 8 then tankn = ' 1A8';
  if block = 1 and tank = 9 then tankn = ' 1A9';
   if block = 1 and tank = 10 then tankn = '1A10';
    if block = 1 and tank = 11 then tankn = '1A11';
     if block = 1 and tank = 12 then tankn = '1A12';
if block = 2 and tank = 1 then tankn = ' 1B1';
 if block = 2 and tank = 2 then tankn = ' 1B2';
  if block = 2 and tank = 3 then tankn = ' 1B3';
   if block = 2 and tank = 4 then tankn = ' 1B4';
    if block = 2 and tank = 5 then tankn = ' 1B5';
     if block = 2 and tank = 6 then tankn = ' 1B6';
if block = 2 and tank = 7 then tankn = ' 1B7';
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12'; run;
roc sort data= musseldist;
```

AEH-11-PSEUDO-02

Log Book / Pages 2/45
File Folder 12 B
Initials KMW Date 7Nov14

PROOFED BY
Initials: _____ Date: _____
REVIEWED BY
Initials: _____ Date: _____
not needed
KMW 7Nov14

Page 5 of 6

```
by round x;
run;
roc print data = musseldist;
itle1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
itle2 h=1 'Random assignment of Plain pocketbook to test tanks';
un;
```

AEH-11-PSEUDO-02

Log Book / Pages 2/45
File Folder 12 B
Initials KMW Date 7nov14

PROOFED BY
Initials: Date
REVIEWED BY
Initials: Date
not needed
KMW 7nov14

Item Number: 6

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.EH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels 5/23/12 1
andom assignment of Higgins eye to test tanks

AEH-11-PSEUDO-02

Began distribution at 1400 JKW 25MAY12

bs	round	block	tank	x	tankn
1	1	2	11	0.05770	1B11
2	1	2	10	0.06182	1B10
3	1	2	1	0.19315	1B1
4	1	1	12	0.20937	1A12
5	1	1	4	0.28057	1A4
6	1	2	2	0.30568	1B2
7	1	1	2	0.33715	1A2
8	1	1	6	0.45297	1A6
9	1	2	9	0.46169	1B9
10	1	1	1	0.48828	1A1
11	1	1	10	0.55625	1A10
12	1	2	3	0.56393	1B3
13	1	1	7	0.56662	1A7
14	1	2	12	0.57017	1B12
15	1	2	6	0.62933	1B6
16	1	2	5	0.63384	1B5
17	1	1	5	0.64733	1A5
18	1	2	4	0.71694	1B4
19	1	1	9	0.73324	1A9
20	1	1	8	0.76333	1A8
21	1	2	7	0.77003	1B7
22	1	1	11	0.82031	1A11
23	1	1	3	0.84377	1A3
24	1	2	8	0.96479	1B8
25	2	2	4	0.04316	1B4
26	2	2	6	0.06922	1B6
27	2	1	5	0.07321	1A5
28	2	1	7	0.13096	1A7
29	2	2	9	0.13138	1B9
30	2	1	4	0.14899	1A4
31	2	2	8	0.23886	1B8
32	2	2	2	0.27164	1B2
33	2	2	7	0.29896	1B7
34	2	1	8	0.30386	1A8
35	2	2	12	0.30735	1B12
36	2	1	11	0.41922	1A11
37	2	2	10	0.57385	1B10
38	2	1	1	0.70536	1A1
39	2	2	5	0.71358	1B5
40	2	1	12	0.74459	1A12
41	2	1	6	0.78166	1A6
42	2	1	9	0.80370	1A9
43	2	2	1	0.80677	1B1
44	2	2	11	0.82516	1B11
45	2	2	3	0.84184	1B3
46	2	1	2	0.85650	1A2
47	2	1	10	0.86259	1A10
48	2	1	3	0.93492	1A3

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~~Initials: Date:~~
~~REVIEWED BY~~
~~Initials: Date:~~
not needed
JKW 7Nov14

Item Number: 8

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Completed Distribution at 1630
5/25/12
JW

nalysis performed by J. Luoma SAS version 9.2 07:17 23MAY12

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Initials KW Date 7nov14

PROOFED BY
Initials: Date :
REVIEWED BY
Initials: Date:
not needed
KW 7nov14

AEH-11-PSEUDO-02

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```
*  Verified by:  _______  (Date:_______)                    page ____ of ____
*  Random allocation of mussel to exposure chambers.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

/*Random distribution of Mussels to experimental tanks*/
/* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
   round = distribution rounds 1 to 2, place one aliquot of mussels per tank per round */

/**************************************************************************************
! **********/

/*Mussel species: Higgins eye*/
data mussel;
 do round = 1 to 2 by 1;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
  end;
 end;
run;

OTE: The data set WORK.MUSSEL has 48 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data musseldist; set mussel;
if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
```

AEH-11-PSEUDO-02

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Initials PW Date 7Nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed
PW 7Nov14

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```
if block = 2 and tank = 8 then tankn = ' 1B8';
 if block = 2 and tank = 9 then tankn = ' 1B9';
  if block = 2 and tank = 10 then tankn = '1B10';
   if block = 2 and tank = 11 then tankn = '1B11';
    if block = 2 and tank = 12 then tankn = '1B12'; run;

OTE: There were 48 observations read from the data set WORK.MUSSEL.
OTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds
```

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AEH-11-PSEUDO-02

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Initials: Date :
REVIEWED BY
Initials: Date:
not needed
jmw 7nov14

```
proc sort data= musseldist;
 by round x;
 run;

OTE: There were 48 observations read from the data set WORK.MUSSELDIST.
OTE: The data set WORK.MUSSELDIST has 48 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds

proc print data = musseldist;
title1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
title2 h=1 'Random assignment of Higgins eye to test tanks';
run;

OTE: There were 48 observations read from the data set WORK.MUSSELDIST.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

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REVIEWED BY
Initials: ____ Date: ____
not needed
HW 7Nov14

AEH-11-PSEUDO-02

```
  Study Number   : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created   : 23May12 - JAL JAL
  Verified by:   _______ (Date:_______)                  page ____ of ____
  Random allocation of mussel to exposure chambers.sas
*****************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-'  pageno = 1 nocenter nodate nosource2;

*Random distribution of Mussels to experimental tanks*/
* tank 1 to 18 = tank A1 to A6 (1-6), tank B1 to B6 (7-12), tank C1 to C6 (13-18)
  round = distribution rounds 1 to 2, place one aliquot of mussels per tank per round */

*********************************************************************************************

*Mussel species: Higgins eye*/
ata mussel;
do round = 1 to 2 by 1;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
 end;
end;
un;
ata musseldist; set mussel;
f block = 1 and tank = 1 then tankn = ' 1A1';
 if block = 1 and tank = 2 then tankn = ' 1A2';
  if block = 1 and tank = 3 then tankn = ' 1A3';
   if block = 1 and tank = 4 then tankn = ' 1A4';
    if block = 1 and tank = 5 then tankn = ' 1A5';
     if block = 1 and tank = 6 then tankn = ' 1A6';
f block = 1 and tank = 7 then tankn = ' 1A7';
 if block = 1 and tank = 8 then tankn = ' 1A8';
  if block = 1 and tank = 9 then tankn = ' 1A9';
   if block = 1 and tank = 10 then tankn = '1A10';
    if block = 1 and tank = 11 then tankn = '1A11';
     if block = 1 and tank = 12 then tankn = '1A12';
if block = 2 and tank = 1 then tankn = ' 1B1';
 if block = 2 and tank = 2 then tankn = ' 1B2';
  if block = 2 and tank = 3 then tankn = ' 1B3';
   if block = 2 and tank = 4 then tankn = ' 1B4';
    if block = 2 and tank = 5 then tankn = ' 1B5';
     if block = 2 and tank = 6 then tankn = ' 1B6';
if block = 2 and tank = 7 then tankn = ' 1B7';
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12'; run;
roc sort data= musseldist;
```

Page 5 of 8

```
by round x;
run;
roc print data = musseldist;
itle1 h=1 'AEH-11-PSUEDO-02: Effects of Pf-CL145A to juvenile mussels';
itle2 h=1 'Random assignment of Higgins eye to test tanks';
un;
```

5/23/12
JP

Log Book / Pages 2/49
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AEH-11-PSEUDO-02

PROOFED BY
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REVIEWED BY
Initials: Date:
not needed
KW 7nov14

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```
  Study Number  : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created  : 23 MAY 2012 - JAL
  Verified by:  _______ (Date:_______)                page ____ of ____
  Random allocation of treatment to tank.sas
**************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

*Random assignment of treatment to experimental tanks*/
*Mussel speces: Higgins Eye*/
ata BSS;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata BSS2; set BSS;
if block = 1 and tank = 1 then tankn = ' 1A1';
 if block = 1 and tank = 2 then tankn = ' 1A2';
  if block = 1 and tank = 3 then tankn = ' 1A3';
   if block = 1 and tank = 4 then tankn = ' 1A4';
    if block = 1 and tank = 5 then tankn = ' 1A5';
     if block = 1 and tank = 6 then tankn = ' 1A6';
f block = 1 and tank = 7 then tankn = ' 1A7';
 if block = 1 and tank = 8 then tankn = ' 1A8';
  if block = 1 and tank = 9 then tankn = ' 1A9';
   if block = 1 and tank = 10 then tankn = '1A10';
    if block = 1 and tank = 11 then tankn = '1A11';
     if block = 1 and tank = 12 then tankn = '1A12';
if block = 2 and tank = 1 then tankn = ' 1B1';
 if block = 2 and tank = 2 then tankn = ' 1B2';
  if block = 2 and tank = 3 then tankn = ' 1B3';
   if block = 2 and tank = 4 then tankn = ' 1B4';
    if block = 2 and tank = 5 then tankn = ' 1B5';
     if block = 2 and tank = 6 then tankn = ' 1B6';
if block = 2 and tank = 7 then tankn = ' 1B7';
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12';
   run;
roc sort data=BSS2;
by block x;
un;

ata assign_trt_BSS; set BSS2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
```

AEH-11-PSEUDO-02

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File Folder 12 B
Initials [illegible] Date 7 Nov 14

PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
Not needed
[illegible] 7 Nov 14

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5/21/12
SRL

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REVIEWED BY
Initials: ____ Date: ____
not needed
KW 7nov14

```
if _n_ = 3 then trt = '50';
if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
if _n_ = 6 then trt = '100';
if _n_ = 7 then trt = '200';
if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
if _n_ = 10 then trt = '300';
if _n_ = 11 then trt = '300-HD';
if _n_ = 12 then trt = '300-HD';
if _n_ = 13 then trt = 'control';
if _n_ = 14 then trt = 'control';
if _n_ = 15 then trt = '50';
if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
if _n_ = 18 then trt = '100';
if _n_ = 19 then trt = '200';
if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
if _n_ = 22 then trt = '300';
if _n_ = 23 then trt = '300-HD';
if _n_ = 24 then trt = '300-HD';    run;
roc sort data= assign_trt_BSS;
y block tank; run;

roc print data= assign_trt_BSS;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of treatment to experimental tanks';
itle5 h=1 'Mussel speces: Higgins eye';
un;
```

AEH-11-PSEUDO-02

Item Number: 8

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AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species 1
AEH-11-PSUEDO-02
Random assignment of treatment to experimental tanks
Mussel species: Hickory nut

Obs	block	tank	x	tankn	trt
1	1	1	0.61968	1A1	200
2	1	2	0.11103	1A2	control
3	1	3	0.89970	1A3	300
4	1	4	0.31044	1A4	50
5	1	5	0.13691	1A5	control
6	1	6	0.53315	1A6	100
7	1	7	0.25764	1A7	50
8	1	8	0.96382	1A8	300-HD
9	1	9	0.49104	1A9	100
10	1	10	0.92950	1A10	300-HD
11	1	11	0.55420	1A11	200
12	1	12	0.90159	1A12	300
13	2	1	0.76848	1B1	300
14	2	2	0.07605	1B2	control
15	2	3	0.27403	1B3	100
16	2	4	0.74329	1B4	300
17	2	5	0.65231	1B5	200
18	2	6	0.78238	1B6	300-HD
19	2	7	0.92026	1B7	300-HD
20	2	8	0.68612	1B8	200
21	2	9	0.21278	1B9	50
22	2	10	0.25922	1B10	100
23	2	11	0.25107	1B11	50
24	2	12	0.20788	1B12	control

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File Folder 12C
Initials KLW Date 27JUL11

PROOFED BY
Initials: KLW Date: 27JUL11
REVIEWED BY
Initials: ____ Date: ____
not needed KLW 7Nov14

Item Number: 2

Pg 1 of 10

Analysis performed by M. Gaikowski SAS version 9.2 15:39 07JUL11 MM

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species 2
AEH-11-PSUEDO-02
Random assignment of treatment to experimental tanks
Mussel species: Mucket

Obs	block	tank	x	tankn	trt
1	1	1	0.37946	2A1	200
2	1	2	0.53122	2A2	300
3	1	3	0.30255	2A3	50
4	1	4	0.12079	2A4	control
5	1	5	0.49781	2A5	200
6	1	6	0.36211	2A6	100
7	1	7	0.34188	2A7	100
8	1	8	0.80502	2A8	300-HD
9	1	9	0.65471	2A9	300
10	1	10	0.24673	2A10	50
11	1	11	0.15408	2A11	control
12	1	12	0.77460	2A12	300-HD
13	2	1	0.97200	2B1	300-HD
14	2	2	0.91681	2B2	300
15	2	3	0.61409	2B3	100
16	2	4	0.89827	2B4	300
17	2	5	0.30278	2B5	50
18	2	6	0.93071	2B6	300-HD
19	2	7	0.00100	2B7	control
20	2	8	0.73872	2B8	100
21	2	9	0.32982	2B9	50
22	2	10	0.20051	2B10	control
23	2	11	0.82685	2B11	200
24	2	12	0.79338	2B12	200

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PROOFED BY
Initials: KW Date: 27 JUL 11
REVIEWED BY
Initials: ____ Date: ____
not needed per protocol

Pg 2 of 10

Analysis performed by M. Gaikowski SAS version 9.2 15:39 07JUL11 MPL

```
*  date created  : 07Jul11 - MPG
*  Verified by:  _______ (Date:_______)                    page ____ of ____
*  Random allocation of treatment to tank.test 2.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by M. Gaikowski SAS version ' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Hickory nut*/
data HNT;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

NOTE: The data set WORK.HNT has 24 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


data HNT2; set HNT;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
     run;

NOTE: There were 24 observations read from the data set WORK.HNT.
NOTE: The data set WORK.HNT2 has 24 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

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PROOFED BY
Initials KLW Date 27JUL11
REVIEWED BY
Initials ___ Date ___
not needed per mpg

Pg 3 of 10

```
proc sort data=HNT2;
 by block x;
run;

NOTE: There were 24 observations read from the data set WORK.HNT2.
NOTE: The data set WORK.HNT2 has 24 observations and 4 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


data assign_trt_HNT; set HNT2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';    run;

NOTE: There were 24 observations read from the data set WORK.HNT2.
NOTE: The data set WORK.ASSIGN_TRT_HNT has 24 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc sort data= assign_trt_HNT;
by block tank; run;

NOTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_HNT.
NOTE: The data set WORK.ASSIGN_TRT_HNT has 24 observations and 5 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


proc print data= assign_trt_HNT;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
```

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File Folder 126
Init KW 27Mar11

PROOFED BY
Initials KW Date 27Mar11
REVIEWED
Initials ______ Date ______

Not needed KW [illegible]

```
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Hickory nut';
run;

NOTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_HNT.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


/***********************************************************************************************
******************/
/*Mussel speces: Mucket*/
data MKT;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

NOTE: The data set WORK.MKT has 24 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


data MKT2; set MKT;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
 if block = 1 and tank = 8 then tankn = ' 2A8';
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
    if block = 1 and tank = 11 then tankn = '2A11';
     if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
     if block = 2 and tank = 5 then tankn = ' 2B5';
      if block = 2 and tank = 6 then tankn = ' 2B6';
 if block = 2 and tank = 7 then tankn = ' 2B7';
  if block = 2 and tank = 8 then tankn = ' 2B8';
   if block = 2 and tank = 9 then tankn = ' 2B9';
    if block = 2 and tank = 10 then tankn = '2B10';
     if block = 2 and tank = 11 then tankn = '2B11';
      if block = 2 and tank = 12 then tankn = '2B12';
    run;

NOTE: There were 24 observations read from the data set WORK.MKT.
NOTE: The data set WORK.MKT2 has 24 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds
```

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Initials KLW Date 27 Mu11

PROOFED BY
Initials KLW Date 27 Mu11
REVIEWED BY
Initials Date
not needed KLW 27Mu11

```
proc sort data=MKT2;
 by block x;
run;

NOTE: There were 24 observations read from the data set WORK.MKT2.
NOTE: The data set WORK.MKT2 has 24 observations and 4 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


data assign_treat_MKT; set MKT2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';     run;

NOTE: There were 24 observations read from the data set WORK.MKT2.
NOTE: The data set WORK.ASSIGN_TREAT_MKT has 24 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc sort data = assign_treat_MKT;
by block tank; run;

NOTE: There were 24 observations read from the data set WORK.ASSIGN_TREAT_MKT.
NOTE: The data set WORK.ASSIGN_TREAT_MKT has 24 observations and 5 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.07 seconds
      cpu time            0.00 seconds


proc print data = assign_treat_MKT;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
```

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File Folder 12c
Initials KW 27Jul11

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Initials KW Date: 27Jul11
REVIEWED BY
Initials Date:
not needed KW 7Nov14

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AEH-11-PSEUDO-02

```
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Mucket';
run;

NOTE: There were 24 observations read from the data set WORK.ASSIGN_TREAT_MKT.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.01 seconds
      cpu time            0.00 seconds
```

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Initials KWW Date 27 MAR 11

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not needed KWW 7 Nov 14

Pg 7 of 10

```
/*******************************************************************          AEH-11-PSEUDO-02
*  Study Number  : AEH-11-PSUEDO-02
*  Study Director: Jim Luoma
*  date created  : 07Jul11 - MPG mpg
*  Verified by:  _______ (Date:_______)                   page ____ of ____
*  Random allocation of treatment to tank.test 2.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by M. Gaikowski SAS version ' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Hickory nut*/
data HNT;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;
data HNT2; set HNT;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
    run;
proc sort data=HNT2;
 by block x;
run;

data assign_trt_HNT; set HNT2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
```

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not needed
LW 7Nov11

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```
  if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';    run;
proc sort data= assign_trt_HNT;
by block tank; run;

proc print data= assign_trt_HNT;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Hickory nut';
run;

/*************************************************************************************************
/*Mussel speces: Mucket*/
data MKT;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;
data MKT2; set MKT;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
   if block = 1 and tank = 9 then tankn = ' 2A9';
    if block = 1 and tank = 10 then tankn = '2A10';
     if block = 1 and tank = 11 then tankn = '2A11';
      if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
     if block = 2 and tank = 5 then tankn = ' 2B5';
      if block = 2 and tank = 6 then tankn = ' 2B6';
 if block = 2 and tank = 7 then tankn = ' 2B7';
  if block = 2 and tank = 8 then tankn = ' 2B8';
   if block = 2 and tank = 9 then tankn = ' 2B9';
    if block = 2 and tank = 10 then tankn = '2B10';
```

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REVIEWED BY
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not needed per mm

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```
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;
proc sort data=MKT2;
 by block x;
run;

data assign_treat_MKT; set MKT2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';     run;

proc sort data = assign_treat_MKT;
by block tank; run;

proc print data = assign_treat_MKT;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Mucket';
run;
```

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Initials KW Date 27 Jul 11

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Initials KW Date: 27 Jul 11
REVIEWED
Initials ____ Date: ____
not needed KW 7 Nov 11

MM 07Jul11

Item Number: 2

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species 1

SA 8 DEC 2011

AEH-11-PSUEDO-02
Random assignment of treatment to experimental tanks
Mussel speces: Black sandshell

AEH-11-PSEUDO-02

Obs	block	tank	x	tankn	trt
1	1	1	0.08123	1A1	control
2	1	2	0.27640	1A2	50
3	1	3	0.79469	1A3	300
4	1	4	0.93741	1A4	300-HD
5	1	5	0.95103	1A5	300-HD
6	1	6	0.66770	1A6	200
7	1	7	0.89685	1A7	300
8	1	8	0.72661	1A8	200
9	1	9	0.50898	1A9	100
10	1	10	0.33095	1A10	50
11	1	11	0.07960	1A11	control
12	1	12	0.51785	1A12	100
13	2	1	0.20344	1B1	50
14	2	2	0.33223	1B2	100
15	2	3	0.04673	1B3	control
16	2	4	0.45194	1B4	200
17	2	5	0.92635	1B5	300-HD
18	2	6	0.91847	1B6	300-HD
19	2	7	0.08267	1B7	control
20	2	8	0.27547	1B8	100
21	2	9	0.52226	1B9	200
22	2	10	0.78741	1B10	300
23	2	11	0.60330	1B11	300
24	2	12	0.21386	1B12	50

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Initials jlw Date 7Nov14

Analysis performed by j. luoma SAS version 9.2 10:52 08DEC11

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
AEH-11-PSUEDO-02
Random assignment of treatment to experimental tanks
Mussel speces: Washboard

JAL 08DEC 2011

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REVIEWED BY
Initials: Date:
not needed
jlw 7Nov14

Obs	block	tank	x	tankn	trt
1	1	1	0.20469	2A1	50
2	1	2	0.20476	2A2	100
3	1	3	0.21075	2A3	100
4	1	4	0.52474	2A4	300
5	1	5	0.55576	2A5	300-HD
6	1	6	0.21161	2A6	200
7	1	7	0.62703	2A7	300-HD
8	1	8	0.32709	2A8	300
9	1	9	0.17109	2A9	control
10	1	10	0.27956	2A10	200
11	1	11	0.09518	2A11	control
12	1	12	0.18972	2A12	50
13	2	1	0.11025	2B1	control
14	2	2	0.31079	2B2	50
15	2	3	0.79237	2B3	200
16	2	4	0.90431	2B4	300
17	2	5	0.97724	2B5	300-HD
18	2	6	0.87053	2B6	300
19	2	7	0.16607	2B7	control
20	2	8	0.95589	2B8	300-HD
21	2	9	0.66065	2B9	100
22	2	10	0.71443	2B10	200
23	2	11	0.59899	2B11	50
24	2	12	0.63474	2B12	100

AEH-11-PSEUDO-02

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REVIEWED B
Initials: Date:
not needed kw 7nov11

Analysis performed by j. luoma SAS version 9.2 10:52 08DEC11

AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
AEH-11-PSUEDO-02
Random assignment of treatment to experimental tanks
Mussel species: not used

Jn 08 DEC 2011

Obs	block	tank	x	tankn	trt
1	1	1	0.64657	3A1	200
2	1	2	0.21751	3A2	50
3	1	3	0.63033	3A3	200
4	1	4	0.98358	3A4	300-HD
5	1	5	0.09538	3A5	control
6	1	6	0.83695	3A6	300
7	1	7	0.59136	3A7	100
8	1	8	0.07278	3A8	control
9	1	9	0.11770	3A9	50
10	1	10	0.93890	3A10	300-HD
11	1	11	0.24048	3A11	100
12	1	12	0.73885	3A12	300
13	2	1	0.86072	3B1	300
14	2	2	0.59571	3B2	100
15	2	3	0.92769	3B3	300-HD
16	2	4	0.66057	3B4	100
17	2	5	0.02587	3B5	control
18	2	6	0.05322	3B6	50
19	2	7	0.90498	3B7	300
20	2	8	0.02587	3B8	control
21	2	9	0.93896	3B9	300-HD
22	2	10	0.80279	3B10	200
23	2	11	0.78647	3B11	200
24	2	12	0.38772	3B12	50

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Initials JM Date 2Nov11

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not needed
JM 2Nov11

AEH-11-PSEUDO-02

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AEH-11-PSEUDO-02

```
/*********************************************************************
*  Study Number  : AEH-11-PSUEDO-02
*  Study Director: Jim Luoma
*  date created  : 08 Dec 2011 - MPG
*  Verified by:  _______ (Date:_______)                page ____ of ____
*  Random allocation of treatment to tank.sas
*********************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by j. luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Black sandshell*/
data BSS;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;
data BSS2; set BSS;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
    run;
proc sort data=BSS2;
 by block x;
run;

data assign_trt_BSS; set BSS2;
 if _n_ = 1 then trt = 'control';
```

Jl 08Dec2011

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not needed
Mw 7nov14

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```
if _n_ = 2 then trt = 'control';
 if _n_ = 3 then trt = '50';
  if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';    run;
proc sort data= assign_trt_BSS;
by block tank; run;

proc print data= assign_trt_BSS;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Black sandshell';
run;

/**************************************************************************************************
/*Mussel speces: Washboard*/
data WAS;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;
data WAS2; set WAS;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
 if block = 1 and tank = 8 then tankn = ' 2A8';
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
```

SN

Log Book / Pages 2/25
File Folder 126
Initials fw Date 7/10/14
PROOFED BY
Initials: Date:
REVIEWED
Initials: Date:
not needed
fw 7/10/14

AEH-11-PSEUDO-02

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```
if block = 1 and tank = 11 then tankn = '2A11';
if block = 1 and tank = 12 then tankn = '2A12';
if block = 2 and tank = 1 then tankn = ' 2B1';
if block = 2 and tank = 2 then tankn = ' 2B2';
if block = 2 and tank = 3 then tankn = ' 2B3';
if block = 2 and tank = 4 then tankn = ' 2B4';
if block = 2 and tank = 5 then tankn = ' 2B5';
if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
if block = 2 and tank = 8 then tankn = ' 2B8';
if block = 2 and tank = 9 then tankn = ' 2B9';
if block = 2 and tank = 10 then tankn = '2B10';
if block = 2 and tank = 11 then tankn = '2B11';
if block = 2 and tank = 12 then tankn = '2B12';
run;
proc sort data=WAS2;
by block x;
run;

data assign_treat_WAS; set WAS2;
if _n_ = 1 then trt = 'control';
if _n_ = 2 then trt = 'control';
if _n_ = 3 then trt = '50';
if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
if _n_ = 6 then trt = '100';
if _n_ = 7 then trt = '200';
if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
if _n_ = 10 then trt = '300';
if _n_ = 11 then trt = '300-HD';
if _n_ = 12 then trt = '300-HD';
if _n_ = 13 then trt = 'control';
if _n_ = 14 then trt = 'control';
if _n_ = 15 then trt = '50';
if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
if _n_ = 18 then trt = '100';
if _n_ = 19 then trt = '200';
if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
if _n_ = 22 then trt = '300';
if _n_ = 23 then trt = '300-HD';
if _n_ = 24 then trt = '300-HD';    run;

proc sort data = assign_treat_WAS;
by block tank; run;

proc print data = assign_treat_WAS;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel species: Washboard';
run;
```

JAL

Log Book / Pages 2/25
File Folder 12C
Initials WJ Date 3Nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed
WJ 7Nov14

AEH-11-PSEUDO-02

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```
/*********************************************************************************************************
/*Mussel speces: NOT USED*/
data was;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;
data was2; set was;
data was2; set was;
 if block = 1 and tank = 1 then tankn = ' 3A1';
  if block = 1 and tank = 2 then tankn = ' 3A2';
   if block = 1 and tank = 3 then tankn = ' 3A3';
    if block = 1 and tank = 4 then tankn = ' 3A4';
     if block = 1 and tank = 5 then tankn = ' 3A5';
      if block = 1 and tank = 6 then tankn = ' 3A6';
if block = 1 and tank = 7 then tankn = ' 3A7';
  if block = 1 and tank = 8 then tankn = ' 3A8';
   if block = 1 and tank = 9 then tankn = ' 3A9';
    if block = 1 and tank = 10 then tankn = '3A10';
     if block = 1 and tank = 11 then tankn = '3A11';
      if block = 1 and tank = 12 then tankn = '3A12';
 if block = 2 and tank = 1 then tankn = ' 3B1';
  if block = 2 and tank = 2 then tankn = ' 3B2';
   if block = 2 and tank = 3 then tankn = ' 3B3';
    if block = 2 and tank = 4 then tankn = ' 3B4';
     if block = 2 and tank = 5 then tankn = ' 3B5';
      if block = 2 and tank = 6 then tankn = ' 3B6';
 if block = 2 and tank = 7 then tankn = ' 3B7';
  if block = 2 and tank = 8 then tankn = ' 3B8';
   if block = 2 and tank = 9 then tankn = ' 3B9';
    if block = 2 and tank = 10 then tankn = '3B10';
     if block = 2 and tank = 11 then tankn = '3B11';
      if block = 2 and tank = 12 then tankn = '3B12';
    run;
proc sort data=was2;
 by block x;
run;

data assign_treat_was; set was2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
```

AEH-11-PSEUDO-02

Log Book / Pages 2/25
File Folder 12c
Initials [initials] Date 7nov14

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
Not needed
[initials] 7nov14

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```
if _n_ = 13 then trt = 'control';
if _n_ = 14 then trt = 'control';
if _n_ = 15 then trt = '50';
if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
if _n_ = 18 then trt = '100';
if _n_ = 19 then trt = '200';
if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
if _n_ = 22 then trt = '300';
if _n_ = 23 then trt = '300-HD';
if _n_ = 24 then trt = '300-HD';     run;
```

JAL

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Initials JW Date 1Nov14

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Initials: Date:
not needed JW 1Nov14

AEH-11-PSEUDO-02

```
proc sort data= assign_treat_HGE;
by block tank; run;

proc print data= assign_treat_HGE;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: not used';
run;
```

Item Number: 3

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ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed 1
uvenile mussels from seven different unionid species
EH-11-PSUEDO-02
andom assignment of treatment to experimental tanks JAL 1-23-2012
ussel speces: Fatmucket

AEH-11-PSEUDO-02

bs	block	tank	x	tankn	trt
1	1	1	0.10629	1A1	control
2	1	2	0.53642	1A2	100
3	1	3	0.29359	1A3	50
4	1	4	0.74942	1A4	300
5	1	5	0.57556	1A5	200
6	1	6	0.92546	1A6	300-HD
7	1	7	0.10495	1A7	control
8	1	8	0.92001	1A8	300-HD
9	1	9	0.17152	1A9	50
10	1	10	0.67085	1A10	300
11	1	11	0.35870	1A11	100
12	1	12	0.56099	1A12	200
13	2	1	0.59707	1B1	50
14	2	2	0.99429	1B2	300-HD
15	2	3	0.64389	1B3	100
16	2	4	0.87976	1B4	300
17	2	5	0.11919	1B5	control
18	2	6	0.63597	1B6	50
19	2	7	0.73238	1B7	200
20	2	8	0.97830	1B8	300-HD
21	2	9	0.72753	1B9	200
22	2	10	0.54373	1B10	control
23	2	11	0.71449	1B11	100
24	2	12	0.94742	1B12	300

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Initials [illegible] Date 12APR12

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~~REVIEWED BY~~
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not needed
[illegible]

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Item Number: 4

ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed uvenile mussels from seven different unionid species 2
EH-11-PSUEDO-02
andom assignment of treatment to experimental tanks
ussel speces: EMPTY

Log Book / Pages 2/32
File Folder 12c
Initials [illegible] Date [illegible]

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not needed [illegible]

bs	block	tank	x	tankn	trt
1	1	1	0.94651	2A1	300-HD
2	1	2	0.87643	2A2	300
3	1	3	0.99231	2A3	300-HD
4	1	4	0.65411	2A4	100
5	1	5	0.93754	2A5	300
6	1	6	0.38770	2A6	50
7	1	7	0.56469	2A7	100
8	1	8	0.71558	2A8	200
9	1	9	0.26923	2A9	control
10	1	10	0.17910	2A10	control
11	1	11	0.80709	2A11	200
12	1	12	0.33467	2A12	50
13	2	1	0.55683	2B1	300
14	2	2	0.23203	2B2	50
15	2	3	0.84485	2B3	300-HD
16	2	4	0.16394	2B4	50
17	2	5	0.48920	2B5	200
18	2	6	0.29551	2B6	100
19	2	7	0.47238	2B7	200
20	2	8	0.61734	2B8	300-HD
21	2	9	0.29549	2B9	100
22	2	10	0.06658	2B10	control
23	2	11	0.51106	2B11	300
24	2	12	0.13056	2B12	control

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Initials [illegible] Date 7nov11

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Not needed
[illegible] 7nov11

.nalysis performed by J. Luoma SAS version 9.2 09:24 23JAN12

ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed
uvenile mussels from seven different unionid species
EH-11-PSUEDO-02
andom assignment of treatment to experimental tanks
ussel speces: not used

bs	block	tank	x	tankn	trt
1	1	1	0.34819	3A1	200
2	1	2	0.88571	3A2	300-HD
3	1	3	0.32645	3A3	100
4	1	4	0.57912	3A4	300
5	1	5	0.26084	3A5	50
6	1	6	0.68970	3A6	300-HD
7	1	7	0.33684	3A7	100
8	1	8	0.13531	3A8	control
9	1	9	0.45655	3A9	200
10	1	10	0.18908	3A10	50
11	1	11	0.47692	3A11	300
12	1	12	0.05053	3A12	control
13	2	1	0.60194	3B1	100
14	2	2	0.70112	3B2	300
15	2	3	0.68794	3B3	200
16	2	4	0.53866	3B4	50
17	2	5	0.68238	3B5	200
18	2	6	0.01059	3B6	control
19	2	7	0.73946	3B7	300
20	2	8	0.64360	3B8	100
21	2	9	0.31520	3B9	50
22	2	10	0.13145	3B10	control
23	2	11	0.99594	3B11	300-HD
24	2	12	0.92953	3B12	300-HD

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Initials KW Date 7May4

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Initials: Date:
REVIEWED BY
Initials: Date:

not needed KW 7May4

~~AEH-11-PSEUDO-02~~
NL KW 7May4

AEH-11-PSEUDO-02

nalysis performed by J. Luoma SAS version 9.2 09:24 23JAN12

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```
  Study Number  : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created  : 23 JAN 2012 - JAL JL
  Verified by:  _______ (Date:_______)                    page ____ of ____
  Random allocation of treatment to tank.sas
*******************************************************************/
IM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;              AEH-11-PSEUDO-02

OOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

*Random assignment of treatment to experimental tanks*/
*Mussel speces: Fatmucket*/
ata FAM;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata FAM2; set FAM;
if block = 1 and tank = 1 then tankn = ' 1A1';
 if block = 1 and tank = 2 then tankn = ' 1A2';
  if block = 1 and tank = 3 then tankn = ' 1A3';
   if block = 1 and tank = 4 then tankn = ' 1A4';
    if block = 1 and tank = 5 then tankn = ' 1A5';
     if block = 1 and tank = 6 then tankn = ' 1A6';
f block = 1 and tank = 7 then tankn = ' 1A7';
 if block = 1 and tank = 8 then tankn = ' 1A8';
  if block = 1 and tank = 9 then tankn = ' 1A9';
   if block = 1 and tank = 10 then tankn = '1A10';
    if block = 1 and tank = 11 then tankn = '1A11';
     if block = 1 and tank = 12 then tankn = '1A12';
if block = 2 and tank = 1 then tankn = ' 1B1';
 if block = 2 and tank = 2 then tankn = ' 1B2';
  if block = 2 and tank = 3 then tankn = ' 1B3';
   if block = 2 and tank = 4 then tankn = ' 1B4';
    if block = 2 and tank = 5 then tankn = ' 1B5';
     if block = 2 and tank = 6 then tankn = ' 1B6';
if block = 2 and tank = 7 then tankn = ' 1B7';
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12';
   run;
roc sort data=FAM2;
by block x;
un;

ata assign_trt_FAM; set FAM2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
```

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File Folder 12C
Initials EW Date

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed
EW 7Nov14

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```
  if _n_ = 3 then trt = '50';
   if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';     run;
roc sort data= assign_trt_FAM;
y block tank; run;

roc print data= assign_trt_FAM;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of treatment to experimental tanks';
itle5 h=1 'Mussel species: Fatmucket';
un;

**********************************************************************************************
*Mussel species: empty*/
ata EMP;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata EMP2; set EMP;
if block = 1 and tank = 1 then tankn = ' 2A1';
 if block = 1 and tank = 2 then tankn = ' 2A2';
  if block = 1 and tank = 3 then tankn = ' 2A3';
   if block = 1 and tank = 4 then tankn = ' 2A4';
    if block = 1 and tank = 5 then tankn = ' 2A5';
     if block = 1 and tank = 6 then tankn = ' 2A6';
f block = 1 and tank = 7 then tankn = ' 2A7';
 if block = 1 and tank = 8 then tankn = ' 2A8';
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
    if block = 1 and tank = 11 then tankn = '2A11';
     if block = 1 and tank = 12 then tankn = '2A12';
```

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Initials kw

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Initials: Date:

not needed
kw 7Nov14

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```
if block = 2 and tank = 1 then tankn = ' 2B1';
 if block = 2 and tank = 2 then tankn = ' 2B2';
  if block = 2 and tank = 3 then tankn = ' 2B3';
   if block = 2 and tank = 4 then tankn = ' 2B4';
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;
roc sort data=EMP2;
by block x;
un;

ata assign_treat_EMP; set EMP2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
  if _n_ = 3 then trt = '50';
   if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';    run;

roc sort data = assign_treat_EMP;
y block tank; run;

roc print data = assign_treat_EMP;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of treatment to experimental tanks';
itle5 h=1 'Mussel speces: EMPTY';
un;

*****************************************************************************************************
*Mussel speces: NOT USED*/
```

Log Book / Pages 2/32
File Folder 12C
Initials KW Date 7Oct11

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REVIEWED B
Initials: ___ Date: ___
not needed
KW 7nov11

AEH-11-PSEUDO-02

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```
ata NOT;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata NOT2; set NOT;
ata NOT2; set NOT;
if block = 1 and tank = 1 then tankn = ' 3A1';
 if block = 1 and tank = 2 then tankn = ' 3A2';
  if block = 1 and tank = 3 then tankn = ' 3A3';
   if block = 1 and tank = 4 then tankn = ' 3A4';
    if block = 1 and tank = 5 then tankn = ' 3A5';
     if block = 1 and tank = 6 then tankn = ' 3A6';
f block = 1 and tank = 7 then tankn = ' 3A7';
 if block = 1 and tank = 8 then tankn = ' 3A8';
  if block = 1 and tank = 9 then tankn = ' 3A9';
   if block = 1 and tank = 10 then tankn = '3A10';
    if block = 1 and tank = 11 then tankn = '3A11';
     if block = 1 and tank = 12 then tankn = '3A12';
if block = 2 and tank = 1 then tankn = ' 3B1';
 if block = 2 and tank = 2 then tankn = ' 3B2';
  if block = 2 and tank = 3 then tankn = ' 3B3';
   if block = 2 and tank = 4 then tankn = ' 3B4';
    if block = 2 and tank = 5 then tankn = ' 3B5';
     if block = 2 and tank = 6 then tankn = ' 3B6';
if block = 2 and tank = 7 then tankn = ' 3B7';
 if block = 2 and tank = 8 then tankn = ' 3B8';
  if block = 2 and tank = 9 then tankn = ' 3B9';
   if block = 2 and tank = 10 then tankn = '3B10';
    if block = 2 and tank = 11 then tankn = '3B11';
     if block = 2 and tank = 12 then tankn = '3B12';
   run;
roc sort data=NOT2;
by block x;
un;

ata assign_treat_NOT; set NOT2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
  if _n_ = 3 then trt = '50';
   if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
```

AEH-11-PSEUDO-02

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Initials VW Date 3 Nov 11

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not needed VW 3Nov14

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```
if block = 2 and tank = 1 then tankn = ' 2B1';
 if block = 2 and tank = 2 then tankn = ' 2B2';
  if block = 2 and tank = 3 then tankn = ' 2B3';
   if block = 2 and tank = 4 then tankn = ' 2B4';
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;
roc sort data=EMP2;
by block x;
un;

ata assign_treat_EMP; set EMP2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
  if _n_ = 3 then trt = '50';
   if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';     run;

roc sort data = assign_treat_EMP;
y block tank; run;

roc print data = assign_treat_EMP;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Randon assignment of treatment to experimental tanks';
itle5 h=1 'Mussel speces: EMPTY';
un;

****************************************************************************************************
*Mussel speces: NOT USED*/
```

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Initials KW Date 7 Nov 14

PROOFED BY
Initials ____ Date ____
REVIEWED
Initials ____ Date ____
not needed
KW 7 Nov 14

AEH-11-PSEUDO-02

```
ata NOT;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata NOT2; set NOT;
ata NOT2; set NOT;
if block = 1 and tank = 1 then tankn = ' 3A1';
 if block = 1 and tank = 2 then tankn = ' 3A2';
  if block = 1 and tank = 3 then tankn = ' 3A3';
   if block = 1 and tank = 4 then tankn = ' 3A4';
    if block = 1 and tank = 5 then tankn = ' 3A5';
     if block = 1 and tank = 6 then tankn = ' 3A6';
f block = 1 and tank = 7 then tankn = ' 3A7';
 if block = 1 and tank = 8 then tankn = ' 3A8';
  if block = 1 and tank = 9 then tankn = ' 3A9';
   if block = 1 and tank = 10 then tankn = '3A10';
    if block = 1 and tank = 11 then tankn = '3A11';
     if block = 1 and tank = 12 then tankn = '3A12';
if block = 2 and tank = 1 then tankn = ' 3B1';
 if block = 2 and tank = 2 then tankn = ' 3B2';
  if block = 2 and tank = 3 then tankn = ' 3B3';
   if block = 2 and tank = 4 then tankn = ' 3B4';
    if block = 2 and tank = 5 then tankn = ' 3B5';
     if block = 2 and tank = 6 then tankn = ' 3B6';
if block = 2 and tank = 7 then tankn = ' 3B7';
 if block = 2 and tank = 8 then tankn = ' 3B8';
  if block = 2 and tank = 9 then tankn = ' 3B9';
   if block = 2 and tank = 10 then tankn = '3B10';
    if block = 2 and tank = 11 then tankn = '3B11';
     if block = 2 and tank = 12 then tankn = '3B12';
   run;
roc sort data=NOT2;
by block x;
un;

ata assign_treat_NOT; set NOT2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
  if _n_ = 3 then trt = '50';
   if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
```

AEH-11-PSEUDO-02

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REVIEWED BY
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not need
EW 7Nov14

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```
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
 ' if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';    run;

roc sort data= assign_treat_NOT;
y block tank; run;

roc print data= assign_treat_NOT;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of treatment to experimental tanks';
itle5 h=1 'Mussel species: not used';
un;
```

Log Book / Pages 2/32
File Folder 12c
Initials JMW Date 7/...

PROOFED BY
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Not needed
JMW 7 ...

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```
*  Verified by: _______ (Date:____)                              page ____ of ____
*  Random allocation of treatment to tank.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by J. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Fatmucket*/
data FAM;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

OTE: The data set WORK.FAM has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


data FAM2; set FAM;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
    run;

OTE: There were 24 observations read from the data set WORK.FAM.
```

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Initials KM Date 7Nov14

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Initials Date
REVIEWED BY
Initials Date
not needed
KM 7Nov14

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```
OTE: The data set WORK.FAM2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds

 proc sort data=FAM2;
  by block x;
 run;

OTE: There were 24 observations read from the data set WORK.FAM2.
OTE: The data set WORK.FAM2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


 data assign_trt_FAM; set FAM2;
  if _n_ = 1 then trt = 'control';
   if _n_ = 2 then trt = 'control';
    if _n_ = 3 then trt = '50';
     if _n_ = 4 then trt = '50';
  if _n_ = 5 then trt = '100';
   if _n_ = 6 then trt = '100';
    if _n_ = 7 then trt = '200';
     if _n_ = 8 then trt = '200';
  if _n_ = 9 then trt = '300';
   if _n_ = 10 then trt = '300';
    if _n_ = 11 then trt = '300-HD';
     if _n_ = 12 then trt = '300-HD';
   if _n_ = 13 then trt = 'control';
   if _n_ = 14 then trt = 'control';
    if _n_ = 15 then trt = '50';
     if _n_ = 16 then trt = '50';
  if _n_ = 17 then trt = '100';
   if _n_ = 18 then trt = '100';
    if _n_ = 19 then trt = '200';
     if _n_ = 20 then trt = '200';
  if _n_ = 21 then trt = '300';
   if _n_ = 22 then trt = '300';
    if _n_ = 23 then trt = '300-HD';
     if _n_ = 24 then trt = '300-HD';     run;

OTE: There were 24 observations read from the data set WORK.FAM2.
OTE: The data set WORK.ASSIGN_TRT_FAM has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds


 proc sort data= assign_trt_FAM;
 by block tank; run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_FAM.
OTE: The data set WORK.ASSIGN_TRT_FAM has 24 observations and 5 variables.
```

AEH-11-PSEUDO-02

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Initials hw Date 7nov4
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REVIEWED BY
Initials: ____ Date: ____

not needed HW 7nov4

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```
OTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

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File Folder 126
Initials jkw Date 7nov11

```

proc print data= assign_trt_FAM;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Fatmucket';
run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_FAM.
OTE: PROCEDURE PRINT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed
jkw 7nov11

AEH-11-PSEUDO-02

```

/*****************************************************************************************
!  *****************/
/*Mussel speces: empty*/
data EMP;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

OTE: The data set WORK.EMP has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.01 seconds


data EMP2; set EMP;
 if block = 1 and tank = 1 then tankn = ' 2A1';
  if block = 1 and tank = 2 then tankn = ' 2A2';
   if block = 1 and tank = 3 then tankn = ' 2A3';
    if block = 1 and tank = 4 then tankn = ' 2A4';
     if block = 1 and tank = 5 then tankn = ' 2A5';
      if block = 1 and tank = 6 then tankn = ' 2A6';
if block = 1 and tank = 7 then tankn = ' 2A7';
  if block = 1 and tank = 8 then tankn = ' 2A8';
   if block = 1 and tank = 9 then tankn = ' 2A9';
    if block = 1 and tank = 10 then tankn = '2A10';
     if block = 1 and tank = 11 then tankn = '2A11';
      if block = 1 and tank = 12 then tankn = '2A12';
 if block = 2 and tank = 1 then tankn = ' 2B1';
  if block = 2 and tank = 2 then tankn = ' 2B2';
   if block = 2 and tank = 3 then tankn = ' 2B3';
    if block = 2 and tank = 4 then tankn = ' 2B4';
```

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```
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;

OTE: There were 24 observations read from the data set WORK.EMP.
OTE: The data set WORK.EMP2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds
```

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Initials KW Date 7nov14

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Not needed KW 7nov14

AEH-11-PSEUDO-02

```
proc sort data=EMP2;
 by block x;
run;

OTE: There were 24 observations read from the data set WORK.EMP2.
OTE: The data set WORK.EMP2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


data assign_treat_EMP; set EMP2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';    run;

OTE: There were 24 observations read from the data set WORK.EMP2.
```

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```
OTE: The data set WORK.ASSIGN_TREAT_EMP has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds
```

Log Book / Pages 2/32
File Folder 12C
Initials ___ Date ___

PROOFED BY
Initials: ___ Date: ___
REVIEWED BY
Initials: ___ Date: ___
not needed

```
proc sort data = assign_treat_EMP;
by block tank; run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TREAT_EMP.
OTE: The data set WORK.ASSIGN_TREAT_EMP has 24 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

AEH-11-PSEUDO-02

```
proc print data = assign_treat_EMP;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: EMPTY';
run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TREAT_EMP.
OTE: PROCEDURE PRINT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


/*********************************************************************************************
*****************/
/*Mussel speces: NOT USED*/
data NOT;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

OTE: The data set WORK.NOT has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


data NOT2; set NOT;

OTE: There were 24 observations read from the data set WORK.NOT.
OTE: The data set WORK.NOT2 has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
```

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```
     real time           0.01 seconds
     cpu time            0.01 seconds


data NOT2; set NOT;
 if block = 1 and tank = 1 then tankn = ' 3A1';
  if block = 1 and tank = 2 then tankn = ' 3A2';
   if block = 1 and tank = 3 then tankn = ' 3A3';
    if block = 1 and tank = 4 then tankn = ' 3A4';
     if block = 1 and tank = 5 then tankn = ' 3A5';
      if block = 1 and tank = 6 then tankn = ' 3A6';
if block = 1 and tank = 7 then tankn = ' 3A7';
  if block = 1 and tank = 8 then tankn = ' 3A8';
   if block = 1 and tank = 9 then tankn = ' 3A9';
    if block = 1 and tank = 10 then tankn = '3A10';
     if block = 1 and tank = 11 then tankn = '3A11';
      if block = 1 and tank = 12 then tankn = '3A12';
 if block = 2 and tank = 1 then tankn = ' 3B1';
  if block = 2 and tank = 2 then tankn = ' 3B2';
   if block = 2 and tank = 3 then tankn = ' 3B3';
    if block = 2 and tank = 4 then tankn = ' 3B4';
     if block = 2 and tank = 5 then tankn = ' 3B5';
      if block = 2 and tank = 6 then tankn = ' 3B6';
 if block = 2 and tank = 7 then tankn = ' 3B7';
  if block = 2 and tank = 8 then tankn = ' 3B8';
   if block = 2 and tank = 9 then tankn = ' 3B9';
    if block = 2 and tank = 10 then tankn = '3B10';
     if block = 2 and tank = 11 then tankn = '3B11';
      if block = 2 and tank = 12 then tankn = '3B12';
    run;

OTE: There were 24 observations read from the data set WORK.NOT.
OTE: The data set WORK.NOT2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


proc sort data=NOT2;
 by block x;
run;

OTE: There were 24 observations read from the data set WORK.NOT2.
OTE: The data set WORK.NOT2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data assign_treat_NOT; set NOT2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
```

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File Folder 12C
Initials kw Date 7nov14

PROOFED BY
Initials Date
REVIEWED BY
Initials Date
not needed
kw 7nov14

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```
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';     run;
```

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File Folder 12c
Initials KW Date 4Nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed
KW 4Nov14

AEH-11-PSEUDO-02

```
OTE: There were 24 observations read from the data set WORK.NOT2.
OTE: The data set WORK.ASSIGN_TREAT_NOT has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.03 seconds


proc sort data= assign_treat_NOT;
by block tank; run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TREAT_NOT.
OTE: The data set WORK.ASSIGN_TREAT_NOT has 24 observations and 5 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

Item Number: 4

```
proc print data= assign_treat_NOT;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel species: not used';
run;
```

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```
OTE: There were 24 observations read from the data set WORK.ASSIGN_TREAT_NOT.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed 1
uvenile mussels from seven different unionid species
.EH-11-PSUEDO-02
andom assignment of treatment to experimental tanks
ussel speces: Black sandshell

3-28-12
JA

AEH-11-PSEUDO-02

bs	block	tank	x	tankn	trt
1	1	1	0.63090	2A1	200
2	1	2	0.94409	2A2	300-HD
3	1	3	0.53735	2A3	100
4	1	4	0.55006	2A4	200
5	1	5	0.54753	2A5	100
6	1	6	0.08917	2A6	control
7	1	7	0.89247	2A7	300-HD
8	1	8	0.00692	2A8	control
9	1	9	0.30195	2A9	50
10	1	10	0.85526	2A10	300
11	1	11	0.66831	2A11	300
12	1	12	0.29897	2A12	50
13	2	1	0.68325	2B1	300
14	2	2	0.40302	2B2	100
15	2	3	0.91076	2B3	300-HD
16	2	4	0.67824	2B4	300
17	2	5	0.28857	2B5	50
18	2	6	0.48831	2B6	200
19	2	7	0.37269	2B7	100
20	2	8	0.27647	2B8	50
21	2	9	0.18099	2B9	control
22	2	10	0.76544	2B10	300-HD
23	2	11	0.12836	2B11	control
24	2	12	0.58795	2B12	200

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not needed
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Item Number: 5

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nalysis performed by j. Luoma SAS version 9.2 08:56 28MAR12

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Initials: ____ Date: ____

not needed KW 7nov14

AEH-11-PSEUDO-02

Page 7 of 7

```
 * Date Created : 28 MAR 2012 - JAL
 * Verified by: _______ (Date:_______) Jn        page ____ of ____
 * Random allocation of treatment to tank.sas
 *****************************************************************/
 DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

 FOOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

 options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

 /*Random assignment of treatment to experimental tanks*/
 /*Mussel speces: Black sandshell*/
 data BSS;
  do block = 1 to 2 by 1;
   do tank = 1 to 12 by 1;
    x = ranuni(-1);
    output;
   end;
  end;
 run;

OTE: The data set WORK.BSS has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


 data BSS2; set BSS;
  if block = 1 and tank = 1 then tankn = ' 2A1';
   if block = 1 and tank = 2 then tankn = ' 2A2';
    if block = 1 and tank = 3 then tankn = ' 2A3';
     if block = 1 and tank = 4 then tankn = ' 2A4';
      if block = 1 and tank = 5 then tankn = ' 2A5';
       if block = 1 and tank = 6 then tankn = ' 2A6';
 if block = 1 and tank = 7 then tankn = ' 2A7';
   if block = 1 and tank = 8 then tankn = ' 2A8';
    if block = 1 and tank = 9 then tankn = ' 2A9';
     if block = 1 and tank = 10 then tankn = '2A10';
      if block = 1 and tank = 11 then tankn = '2A11';
       if block = 1 and tank = 12 then tankn = '2A12';
  if block = 2 and tank = 1 then tankn = ' 2B1';
   if block = 2 and tank = 2 then tankn = ' 2B2';
    if block = 2 and tank = 3 then tankn = ' 2B3';
     if block = 2 and tank = 4 then tankn = ' 2B4';
      if block = 2 and tank = 5 then tankn = ' 2B5';
       if block = 2 and tank = 6 then tankn = ' 2B6';
  if block = 2 and tank = 7 then tankn = ' 2B7';
   if block = 2 and tank = 8 then tankn = ' 2B8';
    if block = 2 and tank = 9 then tankn = ' 2B9';
     if block = 2 and tank = 10 then tankn = '2B10';
      if block = 2 and tank = 11 then tankn = '2B11';
       if block = 2 and tank = 12 then tankn = '2B12';
     run;

OTE: There were 24 observations read from the data set WORK.BSS.
```

AEH-11-PSEUDO-02

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PROOFED BY
Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed
JMW 3nov14

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```
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.04 seconds
     cpu time            0.03 seconds
```

Log Book / Pages 2/39
File Folder 12c
Initials [illegible] Date 7nov14

PROOFED BY
Initials: Date
REVIEWED B
Initials: Date:

not needed
[illegible] 7nov14

```
proc sort data=BSS2;
 by block x;
run;

OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.00 seconds


data assign_trt_BSS; set BSS2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';    run;
```

AEH-11-PSE[illegible]O-02


```
OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.03 seconds
     cpu time            0.01 seconds


proc sort data= assign_trt_BSS;
by block tank; run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
```

```
OTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
```

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Initials fmw Date 7nov14

```

proc print data= assign_trt_BSS;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Black sandshell';
run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
OTE: PROCEDURE PRINT used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds
```

PROOFED BY
Initials: ____ Date: ____
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Initials: ____ Date: ____

not needed
fmw 7nov14

AEH-11-PSEUDO-02

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```
  Study Number  : AEH-11-PSUEDO-02
  Study Director: Jim Luoma
  date created  : 28 MAR 2012 - JAL
  Verified by:  _______ (Date:_______)                    page ____ of ____
  Random allocation of treatment to tank.sas
*********************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

*Random assignment of treatment to experimental tanks*/
*Mussel speces: Black sandshell*/
ata BSS;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata BSS2; set BSS;
if block = 1 and tank = 1 then tankn = ' 2A1';
 if block = 1 and tank = 2 then tankn = ' 2A2';
  if block = 1 and tank = 3 then tankn = ' 2A3';
   if block = 1 and tank = 4 then tankn = ' 2A4';
    if block = 1 and tank = 5 then tankn = ' 2A5';
     if block = 1 and tank = 6 then tankn = ' 2A6';
f block = 1 and tank = 7 then tankn = ' 2A7';
 if block = 1 and tank = 8 then tankn = ' 2A8';
  if block = 1 and tank = 9 then tankn = ' 2A9';
   if block = 1 and tank = 10 then tankn = '2A10';
    if block = 1 and tank = 11 then tankn = '2A11';
     if block = 1 and tank = 12 then tankn = '2A12';
if block = 2 and tank = 1 then tankn = ' 2B1';
 if block = 2 and tank = 2 then tankn = ' 2B2';
  if block = 2 and tank = 3 then tankn = ' 2B3';
   if block = 2 and tank = 4 then tankn = ' 2B4';
    if block = 2 and tank = 5 then tankn = ' 2B5';
     if block = 2 and tank = 6 then tankn = ' 2B6';
if block = 2 and tank = 7 then tankn = ' 2B7';
 if block = 2 and tank = 8 then tankn = ' 2B8';
  if block = 2 and tank = 9 then tankn = ' 2B9';
   if block = 2 and tank = 10 then tankn = '2B10';
    if block = 2 and tank = 11 then tankn = '2B11';
     if block = 2 and tank = 12 then tankn = '2B12';
   run;
roc sort data=BSS2;
 by block x;
un;

ata assign_trt_BSS; set BSS2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
```

AEH-11-PSEUDO-02

Log Book / Pages 2/39
File Folder TC
Initials KW Date 7NOV14

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REVIEWED BY
Initials: ____ Date: ____
not needed
KW 7NOV14

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```
  if _n_ = 3 then trt = '50';
   if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
 if _n_ = 6 then trt = '100';
  if _n_ = 7 then trt = '200';
   if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
 if _n_ = 10 then trt = '300';
  if _n_ = 11 then trt = '300-HD';
   if _n_ = 12 then trt = '300-HD';
 if _n_ = 13 then trt = 'control';
 if _n_ = 14 then trt = 'control';
  if _n_ = 15 then trt = '50';
   if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
 if _n_ = 18 then trt = '100';
  if _n_ = 19 then trt = '200';
   if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
 if _n_ = 22 then trt = '300';
  if _n_ = 23 then trt = '300-HD';
   if _n_ = 24 then trt = '300-HD';    run;
roc sort data= assign_trt_BSS;
y block tank; run;

roc print data= assign_trt_BSS;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of treatment to experimental tanks';
itle5 h=1 'Mussel speces: Black sandshell';
un;
```

Log Book / Pages 2/39
File Folder 12c
Initials [illegible] Date [illegible]

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____
not needed
[illegible]

AEH-11-PSEUDO-02

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:ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed uvenile mussels from seven different unionid species 1
ιEH-11-PSUEDO-02
:andom assignment of treatment to experimental tanks
lussel speces: Plain Pocketbook

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J

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Initials: Date:
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Initials: Date:
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Km 7nov14

AEH-11-PSEUDO-02

ıbs	block	tank	x	tankn	trt
1	1	1	0.06985	1A1	control
2	1	2	0.88913	1A2	300-HD
3	1	3	0.16235	1A3	control
4	1	4	0.87236	1A4	300-HD
5	1	5	0.54779	1A5	200
6	1	6	0.39142	1A6	100
7	1	7	0.39348	1A7	100
8	1	8	0.21372	1A8	50
9	1	9	0.63119	1A9	300
10	1	10	0.29521	1A10	50
11	1	11	0.39421	1A11	200
12	1	12	0.66472	1A12	300
13	2	1	0.98853	1B1	300-HD
14	2	2	0.82654	1B2	300
15	2	3	0.13197	1B3	50
16	2	4	0.91426	1B4	300-HD
17	2	5	0.29006	1B5	100
18	2	6	0.35263	1B6	200
19	2	7	0.33244	1B7	100
20	2	8	0.13562	1B8	50
21	2	9	0.07339	1B9	control
22	2	10	0.13079	1B10	control
23	2	11	0.84900	1B11	300
24	2	12	0.70439	1B12	200

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nalysis performed by j. Luoma SAS version 9.2 14:35 02MAY12

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AEH-11-PSEUDO-02

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Initials: ____ Date: ____
REVIEWED BY
Initials ____ Date: ____

not needed
VMW 7nov14

Page 2 of 7

```
 *  Verified by:  _______ (Date:_______)
 *  Random allocation of treatment to tank.sas
 *******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
/ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Plain pocketbook*/
data BSS;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

IOTE: The data set WORK.BSS has 24 observations and 3 variables.
IOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.01 seconds


data BSS2; set BSS;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
    run;

OTE: There were 24 observations read from the data set WORK.BSS.
```

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Log Book / Pages 2/45 126
File Folder
Initials fw Date 7nov14

PROOFED BY
Initials: ____ Date: ____
REVIEWED B
Initials: ____ Date: ____
not needed fw 7nov14

AEH-11-PSEUDO-02

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```
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.02 seconds
     cpu time            0.03 seconds
```

Log Book / Pages 2/45
File Folder RC
Initials MW Date 7nov14

PROOFED BY
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REVIEWED BY
Initials: ___ Date: ___

Not needed MW 7nov14

```
proc sort data=BSS2;
 by block x;
run;

OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds


data assign_trt_BSS; set BSS2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';    run;
```

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```
OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.02 seconds
     cpu time            0.03 seconds


proc sort data= assign_trt_BSS;
by block tank; run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
```

```
     real time           0.00 seconds
     cpu time            0.01 seconds
```

5/2/12

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File Folder 12C
Initials ____ Date 7Nov14

```
proc print data= assign_trt_BSS;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Plain Pocketbook';
run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
OTE: PROCEDURE PRINT used (Total process time):
     real time           0.01 seconds
     cpu time            0.01 seconds
```

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Initials: ____ Date: ____
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Initials: ____ Date: ____
Not needed
7Nov14

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```
Study Number   : AEH-11-PSUEDO-02
Study Director: Jim Luoma
date created   : 02 MAY 2012 - JAL JA
Verified by:   _______ (Date:_______)                    page ____ of ____
Random allocation of treatment to tank.sas
*******************************************************************/
M 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

OOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;

ptions ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

*Random assignment of treatment to experimental tanks*/
*Mussel speces: Plain pocketbook*/
ata BSS;
do block = 1 to 2 by 1;
 do tank = 1 to 12 by 1;
  x = ranuni(-1);
  output;
 end;
end;
un;
ata BSS2; set BSS;
if block = 1 and tank = 1 then tankn = ' 1A1';
 if block = 1 and tank = 2 then tankn = ' 1A2';
  if block = 1 and tank = 3 then tankn = ' 1A3';
   if block = 1 and tank = 4 then tankn = ' 1A4';
    if block = 1 and tank = 5 then tankn = ' 1A5';
     if block = 1 and tank = 6 then tankn = ' 1A6';
f block = 1 and tank = 7 then tankn = ' 1A7';
 if block = 1 and tank = 8 then tankn = ' 1A8';
  if block = 1 and tank = 9 then tankn = ' 1A9';
   if block = 1 and tank = 10 then tankn = '1A10';
    if block = 1 and tank = 11 then tankn = '1A11';
     if block = 1 and tank = 12 then tankn = '1A12';
if block = 2 and tank = 1 then tankn = ' 1B1';
 if block = 2 and tank = 2 then tankn = ' 1B2';
  if block = 2 and tank = 3 then tankn = ' 1B3';
   if block = 2 and tank = 4 then tankn = ' 1B4';
    if block = 2 and tank = 5 then tankn = ' 1B5';
     if block = 2 and tank = 6 then tankn = ' 1B6';
if block = 2 and tank = 7 then tankn = ' 1B7';
 if block = 2 and tank = 8 then tankn = ' 1B8';
  if block = 2 and tank = 9 then tankn = ' 1B9';
   if block = 2 and tank = 10 then tankn = '1B10';
    if block = 2 and tank = 11 then tankn = '1B11';
     if block = 2 and tank = 12 then tankn = '1B12';
   run;
roc sort data=BSS2;
by block x;
un;

ata assign_trt_BSS; set BSS2;
if _n_ = 1 then trt = 'control';
 if _n_ = 2 then trt = 'control';
```

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Initials KMW Date 7nov14

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not needed
KMW 7nov14

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```
if _n_ = 3 then trt = '50';
if _n_ = 4 then trt = '50';
if _n_ = 5 then trt = '100';
if _n_ = 6 then trt = '100';
if _n_ = 7 then trt = '200';
if _n_ = 8 then trt = '200';
if _n_ = 9 then trt = '300';
if _n_ = 10 then trt = '300';
if _n_ = 11 then trt = '300-HD';
if _n_ = 12 then trt = '300-HD';
if _n_ = 13 then trt = 'control';
if _n_ = 14 then trt = 'control';
if _n_ = 15 then trt = '50';
if _n_ = 16 then trt = '50';
if _n_ = 17 then trt = '100';
if _n_ = 18 then trt = '100';
if _n_ = 19 then trt = '200';
if _n_ = 20 then trt = '200';
if _n_ = 21 then trt = '300';
if _n_ = 22 then trt = '300';
if _n_ = 23 then trt = '300-HD';
if _n_ = 24 then trt = '300-HD';    run;
roc sort data= assign_trt_BSS;
y block tank; run;

roc print data= assign_trt_BSS;
itle1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
itle2 h=1 'juvenile mussels from seven different unionid species';
itle3 h=1 'AEH-11-PSUEDO-02';
itle4 h=1 'Random assignment of treatment to experimental tanks';
itle5 h=1 'Mussel speces: Plain Pocketbook';
un;
```

AEH-11-PSEUDO-02

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Initials: Date:
REVIEWED BY
Initials: Date:
Not needed
FMW 7Nov14

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'ffects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed uvenile mussels from seven different unionid species 5/23/12 J 1
.EH-11-PSUEDO-02
.andom assignment of treatment to experimental tanks
ussel speces: Higgins eye

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File Folder 12C
Initials KW Date 7ran4

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Initials: ____ Date: ____
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Initials: ____ Date: ____
not needed KW 7ran4

bs	block	tank	x	tankn	trt
1	1	1	0.00835	1A1	control
2	1	2	0.60605	1A2	300
3	1	3	0.24472	1A3	100
4	1	4	0.59595	1A4	200
5	1	5	0.75791	1A5	300-HD
6	1	6	0.06266	1A6	50
7	1	7	0.93239	1A7	300-HD
8	1	8	0.04116	1A8	control
9	1	9	0.32822	1A9	100
10	1	10	0.13429	1A10	50
11	1	11	0.33214	1A11	200
12	1	12	0.65314	1A12	300
13	2	1	0.32119	1B1	control
14	2	2	0.57707	1B2	200
15	2	3	0.49158	1B3	100
16	2	4	0.32466	1B4	50
17	2	5	0.62230	1B5	200
18	2	6	0.63153	1B6	300
19	2	7	0.93692	1B7	300-HD
20	2	8	0.21906	1B8	control
21	2	9	0.47496	1B9	100
22	2	10	0.39196	1B10	50
23	2	11	0.91912	1B11	300-HD
24	2	12	0.89877	1B12	300

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Item Number: 8

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nalysis performed by j. Luoma SAS version 9.2 07:27 23MAY12

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AEH-11-PSEUDO-02

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JAW 7nov11

Page 2 of 8

```
*  Verified by: _______ (Date:_______)                          page ____ of ____
*  Random allocation of treatment to tank.sas
*******************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Higgins Eye*/
data BSS;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

OTE: The data set WORK.BSS has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.00 seconds


data BSS2; set BSS;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
    run;

OTE: There were 24 observations read from the data set WORK.BSS.
```

AEH-11-PSEUDO-02

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File Folder 12c
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```
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.02 seconds
     cpu time            0.03 seconds
```

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AEH-11-PSEUDO-02

```
proc sort data=BSS2;
 by block x;
run;

OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.01 seconds


data assign_trt_BSS; set BSS2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';    run;
```

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```
OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.02 seconds
     cpu time            0.01 seconds


proc sort data= assign_trt_BSS;
by block tank; run;

IOTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
IOTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
```

```
OTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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Log Book / Pages 2/49
File Folder 12C
Initials kmw Date 7nov11

AEH-11-PSEUDO-02

```
proc print data= assign_trt_BSS;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Higgins eye';
run;
```

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Initials: ____ Date: ____

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```
OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
OTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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```
*  Verified by: _______ (Date:_______)5/23/12 jlu          page ____ of ____
*  Random allocation of treatment to tank.sas
*****************************************************************/
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Analysis performed by j. Luoma SAS version ' &SYSVER &SYSTIME &SYSDATE;
'ARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=58 formdlim='-' pageno = 1 nocenter nodate nosource2;

/*Random assignment of treatment to experimental tanks*/
/*Mussel speces: Higgins Eye*/
data BSS;
 do block = 1 to 2 by 1;
  do tank = 1 to 12 by 1;
   x = ranuni(-1);
   output;
  end;
 end;
run;

OTE: The data set WORK.BSS has 24 observations and 3 variables.
OTE: DATA statement used (Total process time):
     real time           0.01 seconds
     cpu time            0.00 seconds


data BSS2; set BSS;
 if block = 1 and tank = 1 then tankn = ' 1A1';
  if block = 1 and tank = 2 then tankn = ' 1A2';
   if block = 1 and tank = 3 then tankn = ' 1A3';
    if block = 1 and tank = 4 then tankn = ' 1A4';
     if block = 1 and tank = 5 then tankn = ' 1A5';
      if block = 1 and tank = 6 then tankn = ' 1A6';
if block = 1 and tank = 7 then tankn = ' 1A7';
  if block = 1 and tank = 8 then tankn = ' 1A8';
   if block = 1 and tank = 9 then tankn = ' 1A9';
    if block = 1 and tank = 10 then tankn = '1A10';
     if block = 1 and tank = 11 then tankn = '1A11';
      if block = 1 and tank = 12 then tankn = '1A12';
 if block = 2 and tank = 1 then tankn = ' 1B1';
  if block = 2 and tank = 2 then tankn = ' 1B2';
   if block = 2 and tank = 3 then tankn = ' 1B3';
    if block = 2 and tank = 4 then tankn = ' 1B4';
     if block = 2 and tank = 5 then tankn = ' 1B5';
      if block = 2 and tank = 6 then tankn = ' 1B6';
 if block = 2 and tank = 7 then tankn = ' 1B7';
  if block = 2 and tank = 8 then tankn = ' 1B8';
   if block = 2 and tank = 9 then tankn = ' 1B9';
    if block = 2 and tank = 10 then tankn = '1B10';
     if block = 2 and tank = 11 then tankn = '1B11';
      if block = 2 and tank = 12 then tankn = '1B12';
    run;

OTE: There were 24 observations read from the data set WORK.BSS.
```

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Initials: ____ Date: ____

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```
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: DATA statement used (Total process time):
     real time           0.02 seconds
     cpu time            0.03 seconds
```

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AEH-11-PSEUDO-02

```
proc sort data=BSS2;
 by block x;
run;
```

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Initials: Date:
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```
OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.BSS2 has 24 observations and 4 variables.
OTE: PROCEDURE SORT used (Total process time):
     real time           0.00 seconds
     cpu time            0.01 seconds


data assign_trt_BSS; set BSS2;
 if _n_ = 1 then trt = 'control';
  if _n_ = 2 then trt = 'control';
   if _n_ = 3 then trt = '50';
    if _n_ = 4 then trt = '50';
 if _n_ = 5 then trt = '100';
  if _n_ = 6 then trt = '100';
   if _n_ = 7 then trt = '200';
    if _n_ = 8 then trt = '200';
 if _n_ = 9 then trt = '300';
  if _n_ = 10 then trt = '300';
   if _n_ = 11 then trt = '300-HD';
    if _n_ = 12 then trt = '300-HD';
  if _n_ = 13 then trt = 'control';
  if _n_ = 14 then trt = 'control';
   if _n_ = 15 then trt = '50';
    if _n_ = 16 then trt = '50';
 if _n_ = 17 then trt = '100';
  if _n_ = 18 then trt = '100';
   if _n_ = 19 then trt = '200';
    if _n_ = 20 then trt = '200';
 if _n_ = 21 then trt = '300';
  if _n_ = 22 then trt = '300';
   if _n_ = 23 then trt = '300-HD';
    if _n_ = 24 then trt = '300-HD';    run;
```

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```
OTE: There were 24 observations read from the data set WORK.BSS2.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
OTE: DATA statement used (Total process time):
     real time           0.02 seconds
     cpu time            0.01 seconds


proc sort data= assign_trt_BSS;
by block tank; run;

OTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
OTE: The data set WORK.ASSIGN_TRT_BSS has 24 observations and 5 variables.
```

```
OTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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File Folder 12C
Initials Mw Date 7nov14

AEH-11-PSEUDO-02

```
proc print data= assign_trt_BSS;
title1 h=1 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed';
title2 h=1 'juvenile mussels from seven different unionid species';
title3 h=1 'AEH-11-PSUEDO-02';
title4 h=1 'Random assignment of treatment to experimental tanks';
title5 h=1 'Mussel speces: Higgins eye';
run;

IOTE: There were 24 observations read from the data set WORK.ASSIGN_TRT_BSS.
IOTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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Initials: ____ Date: ____
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Initials: ____ Date: ____

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Item Number: 8

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Appendix 4. Test Article Information

Item number	Item description	Number of pages	Report page number
1	Material Safety Data Sheet: MBI–401 FDP	2	276
2	Material Safety Data Sheet: MBI–401 SDP	2	278
3	Test Chemical Stock Preparation Data Form – Stock preparation date July 12, 2011	1	280
4	Test Chemical Stock Preparation Data Form – Stock preparation date July 14, 2011	1	281
5	Test Chemical Stock Preparation Data Form – Stock preparation date December 13, 2011	1	282
6	Test Chemical Stock Preparation Data Form – Stock preparation date January 27, 2012	1	283
7	Test Chemical Stock Preparation Data Form – Stock preparation date April 17, 2012	1	284
8	Test Chemical Stock Preparation Data Form – Stock preparation date May 16, 2011	1	285
9	Test Chemical Stock Preparation Data Form – Stock preparation date May 26, 2011	1	286
10	Newly Metamorphosed Mussel Exposure Dosing Form – dated July 12, 2011	1	287
11	Newly Metamorphosed Mussel Exposure Dosing Form – dated July 14, 2011	1	288
12	Newly Metamorphosed Mussel Exposure Dosing Form – dated December 13, 2011	1	289
13	Newly Metamorphosed Mussel Exposure Dosing Form – dated January 27, 2012	1	290
14	Newly Metamorphosed Mussel Exposure Dosing Form – dated April 17, 2012	1	291
15	Newly Metamorphosed Mussel Exposure Dosing Form – dated May 16, 2012	1	292
16	Newly Metamorphosed Mussel Exposure Dosing Form – dated May 26, 2012	1	293
17	Chemical Stock Solution Determination – Exposure termination date July 13, 2011	1	294
18	Chemical Stock Solution Determination – Exposure termination date July 15, 2011	1	295
19	Chemical Stock Solution Determination – Exposure termination date December 14, 2011	1	296
20	Chemical Stock Solution Determination – Exposure termination date January 28, 2012	1	297
21	Chemical Stock Solution Determination – Exposure termination date April 18, 2012	1	298
22	Chemical Stock Solution Determination – Exposure termination date May 17, 2012	1	299
23	Chemical Stock Solution Determination – Exposure termination date May 27, 2012	1	300
24	Copy of test article information from test article logbook for MBI–401 FDP; lot number 110510FD – used for HIC and MUC exposures	6	301
25	Copy of test article information from test article logbook for MBI–401 FDP; lot number 110928FD – used for WAS exposure	5	307
26	Copy of test article information from test article logbook for MBI–401 SDP; lot number MBI–401 SDP 4655–12–Mix – used for FAM exposure	5	312
27	Copy of test article information from test article logbook for MBI–401 SDP; lot number TR4669–4–(7–8) 2nd shipment – used for BLS exposure	5	317
28	Copy of test article information from test article logbook for MBI–401 SDP; lot number TR 4669–4–(5) – used for PPB and HGE exposures	7	322
29	Post–treatment activity retention report from NYSM for lot MBI–401 FDP 110510FD – Start date of July 20, 2011	2	329

30	Post–treatment activity retention report from NYSM for lot MBI–401 FDP 110928FD – Start date of December 29, 2011	2	331
31	Post–treatment activity retention report from NYSM for lot MBI–401 SDP 4655–12–Mix – Start date of February 9, 2012	2	333
32	Post–treatment activity retention report from NYSM for lot MBI–401 SDP TR–4669–4–(7–8) 2nd shipment – Start date of May 1, 2012	2	335
33	Post–treatment activity retention report from NYSM for lot MBI–401 SDP TR–4669–4–(5) – Start date of May 29, 2012	2	337
34	Post–treatment activity retention report from NYSM for lot MBI–401 SDP TR–4669–4–(5) – Start date of June 6, 2012	2	339

MATERIAL SAFETY DATA SHEET

Product Name: MBI-401 FDP

Trade names/ Synonyms:	MBI-401 FDP
EPA Registration Number:	None
Primary Hazards:	Inhalation

AEH-11-PSEUDO-02

Contact: Marrone Bio Innovations, 2121 Second Street, Suite B-107, Davis, CA 95618
Phone (Business hours): 530-750-2800
www.marronebio.com
For emergencies such as leaks or spills call CHEMTREC 24-hour toll-free hotline at 1.800.424.9300

FF # 8
Item No. 1
Pg 1 of 2

SECTION 1: MATERIAL IDENTIFICATION

INGREDIENT 1

Common Name:	CL145A strain of *Pseudomonas fluorescens*
Chemical Name:	Not applicable
Molecular Formula:	Not applicable
CAS Number:	Not applicable
Percent:	100%

OTHER INGREDIENTS: None

SECTION 2: PHYSICAL DATA

Boiling Point:	Not applicable
Melting Point:	Not applicable
Bulk density:	0.161 g/mL
pH:	6.7
Solubility in Water:	Dispersible in water
Appearance:	Powder
Color:	Tan
Odor:	Musty

SECTION 3: FIRE AND EXPLOSION DATA

Flash Point:	Not flammable
Method:	Not applicable
Extinguishing Media:	Use extinguishing media appropriate for the surrounding fire
Special Fire Fighting Procedures:	None
Unusual Fire and Explosion Hazards:	None

SECTION 4: REACTIVITY

Stability:	Material is non-reactive
Hazardous Polymerization:	Does not occur
Incompatibility:	None known
Hazardous Decomposition Products:	None known
Conditions to avoid:	None known

SECTION 5: HEALTH HAZARDS

Primary Route of Entry:	Oral, Eye, Inhalation
Exposure Limit:	Not established
Corrosive:	Not corrosive
Skin/ Eye Irritation:	May be irritating to skin and eyes for some individuals.
Inhalation:	May be irritating to respiratory tract for some individuals.
Effects of Overexposure:	If product comes in contact with eyes or skin, irritation may occur.
Toxicity:	None of the components of this product are listed as carcinogenic by NTP, IARC, or OSHA
Acute Oral LD_{50}:	>5,000 mg/kg
Acute Dermal LD_{50}:	>5,050 mg/kg
Acute Inhalation LC_{50}:	2.25 mg/L
Dermal Irritation:	Non-irritating
Eye Irritation:	Non-irritating

SECTION 6: FIRST AID

Emergency First Aid Procedures:

If in eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center of doctor for treatment advice.
If inhaled:	Move person to fresh air. If person in not breathing, call 911 or an ambulance. then give artificial respiration, preferably mouth-to-mouth if possible.
If on skin:	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for further treatment advice.
If swallowed:	Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

SECTION 7: SPILL, LEAK AND DISPOSAL PROCEDURES

Steps to be taken in case material is released or spilled:

Wear suitable protective clothing such as long-sleeved shirt, pants, waterproof gloves and shoes with socks. Carefully mop or sweep up spill and place in a closed container for disposal.

Waste disposal method: Dispose of in accordance with all applicable federal, state, and local environmental regulations.

For emergencies such as leaks or spills, call CHEMTREC 24-hour toll-free hotline at 1.800.424.9300.

SECTION 8: SPECIAL HANDLING

Respiratory:	Use a NIOSH approved respirator with any N-95, R-95, P-95 or HE filter for biological products when mixing/loading the product.
Protective gloves:	Wear gloves made of Latex or other impervious, waterproof material
Eye protection:	Safety goggles or safety glasses with side shields recommended.
Other protective clothes:	Clothing to prevent prolonged skin contact as needed such as long-sleeved shirt, long pants and shoes with socks.

SECTION 9: SPECIAL PRECAUTIONS

Precautions to be taken in handling and storing:

Use a NIOSH approved respirator with any N-95, R-95, P-95 or HE filter for biological products when mixing/loading the product.

Store in a dry area inaccessible to children. Store in original containers only. Keep container closed when not in use.

Empty container completely and dispose of in accordance with all applicable federal, state, and local environmental regulations.

Wash any contamination from skin or eyes immediately. Wash hands and exposed skin before eating, drinking, smoking after work or using the toilet.

SECTION 10: SHIPPING REGULATIONS

Proper shipping name:	None
DOT Label (s) Required:	None
Freight Classification:	Insecticides, Fungicides N.O.I., Other Than Poisons. NMFC 102120 Class 60

SARA Title III Hazard Classification:

Immediate (acute) Health:	No
Delayed (chronic) Health:	No
Fire:	No
Sudden Release of Pressure:	No
Reactivity:	No

AEH-11-PSEUDO-02

National Fire Protection Association Rating:

Health:	0
Flammability:	0
Reactivity:	0

This document set forth is based on information that Marrone Bio Innovations, Inc. (MBI) believes to be accurate. No warranty, expressed or implied, is intended. The information is provided solely for your information and consideration and MBI assumes no legal responsibility for use or reliance thereon.

Marrone™
Bio Innovations

FF # 8
Item No. 1
Pg 2 of 2

AEH-11-PSEUDO-02

MATERIAL SAFETY DATA SHEET

MBI-401 Spray Dried Powder, August 2010

Product Name: MBI-401 SDP

Trade names/ Synonyms:	MBI-401 SDP
EPA Registration Number:	None, Experimental
PMRA Research Authorization #:	0030-RP-10
Primary Hazards:	Inhalation

Contact: Marrone Bio Innovations, 2121 Second Street,
Suite B-107, Davis, CA 95618
Phone (Business hours): 530-750-2800
www.marronebioinnovations.com
For emergencies such as leaks or spills call CHEMTREC 24-hour toll-free hotline at 1.800.424.9300

SECTION 1: MATERIAL IDENTIFICATION

INGREDIENT 1

Common Name:	CL145A strain of *Pseudomonas fluorescens*
Chemical Name:	Not applicable
Molecular Formula:	Not applicable
CAS Number:	Not applicable
Percent:	50%

OTHER INGREDIENTS: inert, non-reactive

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Pg 1 of 2

SECTION 2: PHYSICAL DATA

Boiling Point:	Not applicable
Melting Point:	Not applicable
Bulk Density:	0.78 g/ml
Solubility in Water:	Dispersible in water
Appearance:	Powder
Color:	Tan
Odor:	Sweet, musty

SECTION 3: FIRE AND EXPLOSION DATA

Flash Point:	Not flammable
Method:	Not applicable
Extinguishing Media:	Use extinguishing media appropriate for the surrounding fire
Special Fire Fighting Procedures:	None
Unusual Fire and Explosion Hazards:	None

SECTION 4: REACTIVITY

Stability:	Material is non-reactive
Hazardous Polymerization:	Does not occur
Incompatibility:	None known
Hazardous Decomposition Products:	None known
Conditions to avoid:	None known

SECTION 5: HEALTH HAZARDS

Primary Route of Entry:	Skin contact, Eye, Inhalation
Exposure Limit:	Not established
Corrosive:	Not corrosive
Inhalation:	May be irritating to respiratory tract for some individuals. Avoid breathing dust.
Skin/ Eye Irritation:	May be irritating to skin and eyes for some individuals.
Effects of Overexposure:	If product comes in contact with eyes or skin, irritation may occur.
Toxicity:	None of the components of this product are listed as carcinogenic by NTP, IARC, OSHA
Acute studies:	
Acute Oral LD_{50} (Rat):	>5,000 mg/kg (very low toxicity)
Acute Dermal LD_{50} (Rabbit)	>2,000 mg/kg (non-irritating, mild or slight irritation)
Primary Dermal Irritation	Slight Irritation, Class 4
Eye Irritation	Minimal Irritation, Class 4
Inhalation:	>2.25 g/ml, Class 4

SECTION 6: FIRST AID

Emergency First Aid Procedures:

If in eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center of doctor for treatment advice.
If inhaled:	Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
If on skin:	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for further treatment advice.
If swallowed:	Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

MATERIAL SAFETY DATA SHEET

SECTION 7: SPILL, LEAK AND DISPOSAL PROCEDURES

Steps to be taken in case material is released or spilled:

Wear suitable protective clothing such as long-sleeved shirt, pants, waterproof gloves and shoes with socks. Carefully mop or sweep up spill and place in a closed container for disposal.

Waste disposal method: Dispose of in accordance with all applicable federal, state, and local environmental regulations.

For emergencies such as leaks or spills, call CHEMTREC 24-hour toll-free hotline at 1.800.424.9300.

SECTION 8: SPECIAL HANDLING

Respiratory:	Use a NIOSH approved respirator with any N-95, P-95, R-95 or HE filter for biological products when mixing/loading the product.
Protective gloves:	Wear gloves made of Latex or other impervious material.
Eye protection:	Safety goggles or safety glasses with side shields recommended.
Other protective clothes:	Clothing to prevent prolonged skin contact as needed such as long-sleeved shirt, long pants and shoes with socks.

SECTION 9: SPECIAL PRECAUTIONS

Precautions to be taken in handling and storing:

Use a NIOSH approved respirator with any N-95, P-95, R-95 or HE filter for biological products when mixing/loading the product.

Store in a dry area inaccessible to children. Store in original containers only. Keep container closed when not in use.

Empty container completely and dispose of in accordance with all applicable federal, state, and local environmental regulations.

Wash any contamination from skin or eyes immediately. Wash hands and exposed skin before eating, drinking, smoking after work or using the toilet.

SECTION 10: SHIPPING REGULATIONS

Proper shipping name:	None
DOT Label (s) Required:	None
Freight Classification:	Insecticides, Fungicides N.O.I., Other Than Poisons. NMFC 102120 Class 60

SARA Title III Hazard Classification:

Immediate (acute) Health:	None
Delayed (chronic) Health:	None
Fire:	None
Sudden Release of Pressure:	None
Reactivity:	None

National Fire Protection Association Rating:

Health:	None
Flammability:	None
Reactivity:	None

This document set forth is based on information that Marrone Bio Innovations, Inc. (MBI) believes to be accurate. No warranty, expressed or implied, is intended. The information is provided solely for your information and consideration and MBI assumes no legal responsibility for use or reliance thereon.

Marrone™ Bio Innovations

FF # 8
Item No. 2
Pg 2 of 2

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 15A Lab book/pgs: 2/8 Proofed: TJS 19JAN12 Reviewed: JAL 11-21-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # 110510FD Date Rec'd 28 JUN 2011 Exp. Date 14 AUG 2011

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials
Deactive	5.0082	12 JUL 2011/0817	KLW
Active	5.0076	12 JUL 2011/0825	KLW
		KLW Only	one species dosed
		27 JUL 11	

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
Deactive	500 mL	Prepared ~~083~~ ① into heat 0835	Deactive stock for HK	12 JUL 2011	KLW
Active	500 mL	1002	Active stock for HK	12 JUL 2011	KLW
			KLW Only	one species	
				dosed	
			27 JUL 11		

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared at least 1 hr prior to use to allow for deactivation and cooling.

① Wrong time. Stock prepared at 0835 KLW 12 JUL 2011

FF # 15a
Item No. 4
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 15A Lab book/pgs: 2/14 Proofed: TJS 19JAN12 Reviewed: JN 11-21-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # 1105?DFD Date Rec'd 28 JUN 2011 Exp. Date 14 AUG 2011

Chemical Weighing: BAL 1 and BAL3 WTS 1 and WTS 2

Sample I.D.	Sample wt. (g)	Date/Time	Initials
Deactive	5.0010	14JUL11/~~0850~~ ①	KLW
Active	5.0012	14JUL11/~~0855~~ ②	KLW
		KLW Only	one species dosed
		27 JUL11	

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
Deactive	500	Heated @ 0804-0845 Brought to volume 0858	Deactive stock for MUC	14 JUL 11 0905	KLW
Active	500	0905	Active Stock for MUC	14 JUL 11 0905	KLW
			KLW Only	one Species dosed	
			27 JUL11		

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared at least 1 hr prior to use to allow for deactivation and cooling.

① Wrong time. Correct time was 0750. KLW 14 JUL 2011
② Wrong time. Correct time was 0755. KLW 14 JUL 2011

FF # 15a
Item No. 5
Pg 1 of 1

Study Title: **"Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"**

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 15A Lab book/pgs: 2/26 Proofed: TDS 19JAN12 Reviewed: JAL 11-24-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # 110928FD Date Rec'd 6 DEC 11 Exp. Date 18 MAR 12

Chemical Weighing: BAL 1 and 6 WTS 2

Sample I.D.	Sample wt. (g)	Date/Time	Initials
Deactive Stock	5.0055	13 DEC 11 / 0735	KLW
Active Stock	5.0078	13 DEC 11 / 0750	KLW
		KLW 13DEC11 only	one Species dosed.

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
Deactive Stock	500	0900	Into water bath at 0800 out of H_2O bath at 0845 WAS	13DEC11	KLW
Active Stock	500	Started at 0840 Final volume at 0900	WAS	13DEC11	KLW
		KLW 13DEC11	only one dosed.	Species	

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared at least 1 hr prior to use to allow for deactivation and cooling.

FF # 15a
Item No. 6
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15A Lab book/pgs: 2/33,34 Reviewed: DS 31JAN12 Verified: JN 11-21-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # ~~4655-12-MX~~ MBI-401 SDP Date Rec'd 10 JAN 12 Exp. Date 10 JAN 12

Mussel Species FAM System (1) 2 3

Instruments BAL 1 and BAL 6 w/WTS 2

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials
Deactive stock	10.0553	27 JAN 12/0820	KLW
Active stock for FAM	10.0406	27 JAN12/0830	KLW
	Only one species being dosed.		
			KLW 27JAN12

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
Deactive	~~①~~ 500	Into heat at 0840 out of heat at 0925	Deactive for FAM	27 JAN 12 0950	KLW
Active	500	Started at 0930	Active for FAM	27 JAN 12 0950	KLW
		Only one species being dosed, therefore, only			
		1 deactive and 1 active stock needed. KLW			
					27JAN12

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared prior to use to allow for deactivation and cooling.

① Started to write incorrect volume. KLW 27JAN12

This datasheet was approved by [redacted] on 18JAN2012.
11JAN2012/version1.1

FF # 15a
Item No. 7
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15A Lab book/pgs: 2/40-41 Reviewed: TM 23APR12 Verified: J... 11-21-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # TR4169-4-(1-8) (2nd Shipment) Date Rec'd 13MAR12 Exp. Date 26JAN13

Mussel Species BLS System 1 2 3

Instruments BAL 4, BAL 7

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials
Deactive Stock	10.00034	16APR12 1430	KLW
Active Stock	10.00418	16APR12 1430	KLW

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
Deactive Stock	500	into water bath at 0730 out at 0815	Deactive Stock for BLS	17APR12 0815	KLW
Active Stock	500	0815	Active Stock for BLS	17APR12 0815	KLW

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared prior to use to allow for deactivation and cooling.

This datasheet was approved by [redacted] on 18JAN2012.
11JAN2012/version1.1

FF # 15a
Item No. 8
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15A Lab book/pgs: 2/44,45,46, 47 Reviewed: KLW 21NOV14 Verified: JM 11-21-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # TR4669-4-15 Date Rec'd 24APR12 Exp. Date 12 JAN13

Mussel Species PPB System (1) 2 3

Instruments BAL 7, BAL 8

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials
Active Stock	① 5.0009	15MAY12/1450	KLW
Deactive Stock	① 5.00091	15MAY12/1450	KLW
Deactive Stock 2	10.00038	15MAY12/1530	KLW
③ Active Stock 2	10.00092	15MAY12/1530	KLW
Stock #5	10.0044	16MAY12/0820	KLW

*Chemical samples to be stored refrigerated until used for stock preparation.

① Weighed wrong amount of test chemical. These aliquots will not be used. KLW 15MAY12

FF # 15A
Item No. 9
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Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
② Deactive Stock 2	500	Into water bath @ 0730	Deactive Stock for PPB	16MAY12 0730	KLW
③ Active Stock 2	500	0800	Deactive Stock for PPB	16MAY12 0800	KLW
Stock #5	500	0910	Active Stock for PPB	16MAY12 0910	KLW

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared prior to use to allow for deactivation and cooling.

② Stock spilled while shaking. Discarded. KLW 16MAY12

③ This stock was taken to make the deactive stock so it could be in water bath while new aliquot was weighed out. KLW 16MAY12

This datasheet was approved by [redacted] on 18JAN2012.

11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15a Lab book/pgs: 2/50,44 3/43 Reviewed: Verified: 11-21-14

Test Chemical Stock Preparation Data Form

Test Chemical: *Pseudomonas fluorescens* strain 145A

Test Chemical Lot # TR 4667-4-(5) Date Rec'd 24 APR 12 Exp. Date 12 Jan 13

Mussel Species HGE System 1 2 3

Instruments BAL 7, BAL 3

Chemical Weighing:

Sample I.D.	Sample wt. (g)	Date/Time	Initials
HD Stock	10.00374	5/25/12 1:25pm	TMS
Active Stock	10.00365	5/25/12 1:30pm	TMS

*Chemical samples to be stored refrigerated until used for stock preparation.

Stock Preparation:

Sample I.D.	Dilution Vol. (ml)	Dilution time	Use (ie: Active stock for HGE)	Date/ Time	Initials
HD stock	500ml	0755	Heat deactive stock for HGE	5/26/12 0800	Jo
Active Stock	500ml	0845	Active stock for HGE	5/26/12 0914	Jo

*Stocks to be prepared immediately before use, except for heat deactivated stock which will be prepared prior to use to allow for deactivation and cooling.

This datasheet was approved by [redacted] on 12 JAN 2012.
11JAN2012/version1.1

FF # 15a
Item No. 10
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Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 5/2/11

File Folder: 15B [redacted] Lab book/pgs: 2/8 Proofed: TB5 31JAN12 Reviewed: JM 11-24-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: HIC (O. olivaria) **UMESC lot number:** 112800

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: 1004 12JUL11

Date/time (military) of dosing completion: 1032 12JUL11

Chemical Lot : 110510FD **Stock Chemical Sample I.D.** Deactive and Active

Test Solution Preparation Time: 1002 final volume for both Active and Deactive Stocks

Test Solution preparation description (include dilution volume): (0848 to 0926)

Deactive Stock - 5.0082g / 500mL well water heated at 70°C ~45 minutes

Active stock - 5.0016g / 500mL well water at 20°C

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	12 JUL 2011
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 4
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 5/?/11

File Folder: 15[redacted] Lab book/pgs: 2/14 Proofed: TJS 31JAN12 Reviewed: JAL 11-21-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: Actinonaias ligamentina **UMESC lot number:** 112900

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: 0912 14JUL11

Date/time (military) of dosing completion: 0935 14JUL11

Chemical Lot : 110510FD **Stock Chemical Sample I.D.** Deactive / Active

Test Solution Preparation Time: Each brought to final volumes at 0905

Test Solution preparation description (include dilution volume):

Deactive: 5.0010g/500 mL well water. Heated at 70°C from 0804 to 0848

Active: 5.0012g/500 mL well water at 20°C

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	14JUL2011
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 5
Pg 1 of 1

Study Title: **"Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"**

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 5/7/11

File Folder: 15B [redacted] Lab book/pgs: 2/27 Proofed: TDS 31JAN12 Reviewed: JLL 11-21-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: WAS (M. nervosa) **UMESC lot number:** 116100

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: 0900 13DEC11

Date/time (military) of dosing completion: 0940 13DEC11

Chemical Lot : 110928FD **Stock Chemical Sample I.D.** Deactive Stock Active Stock

Test Solution Preparation Time: Each brought to final volume at 0900

Test Solution preparation description (include dilution volume):

Deactive: 5.0055 g/500 mL well water, Heated at 70°C from 0800 to 0845

Active: 5.0078 g/500 mL well water at 20°C.

Additional information:

Witness and form recorded by:

Kerry L Weber	[redacted]	UMESC	13DEC11
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 6
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15B Lab book/pgs: 2/34 Reviewed: TJS 31JAN12 Verified: JAL 11-21-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: FAM (L. siliquoidea) **UMESC lot number:** 121000

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: 1009 27JAN12

Date/time (military) of dosing completion: 1035 27JAN12

Chemical Lot: MBI-401 SDP 4655-12-Mix **Stock Chemical Sample I.D.** Deactive Stock Active Stock

Test Solution Preparation Time: Each brought to final volume at ~0950

Test Solution preparation description (include dilution volume):

Deactive: 10.0553g/500mL well water. Heated at 70°C from 0840 to 0925.
Active: 10.0406g/500mL well water at 20°C.
Each stock was spun on a stir plate. The active stock was in a bucket of ice.

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	27JAN12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 7
Pg 1 of 1

This datasheet was approved by [redacted] on 11JAN2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15B Lab book/pgs: 2/41 Reviewed: TJS 23APR12 Verified: Jnc 11-21-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: BLS **UMESC lot number:** 121400

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: 0910 17APR12

Date/time (military) of dosing completion: 0940 17APR12

Chemical Lot : TR4669-4-(7-8) 2nd Shipment **Stock Chemical Sample I.D.** Deactive stock for BLS Active Stock for BLS

Test Solution Preparation Time: 0910 to 0933

Test Solution preparation description (include dilution volume):

Deactive Stock 10.00034g/500mL UMESC well water heated at 70°C for 45minutes
Active Stock 10.00418g/500mL UMESC well water (20°C)

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	17APR12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 8
Pg 1 of 1

This datasheet was approved by [redacted] on 11JAN2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 15B Lab book/pgs: 2/46-47 Reviewed: KLW 7NOV14 Verified: JA 11-21-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: Plain Pocketbook **UMESC lot number:** 121700

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: 0945 16 MAY 12

Date/time (military) of dosing completion: 1016 16MAY12

Chemical Lot : MBI-401 SDP TR4669-4(5) **Stock Chemical Sample I.D.** Deactive Stock for PPB Stock #5 (Active Stock) for PPB

Test Solution Preparation Time: ~~0910-0933~~ 0945-1009 wrong times. KLW 16MAY12

Test Solution preparation description (include dilution volume):

Deactive Stock 10.00092 g/500mL UMESC well water heated at 70°C for 45 minutes

Active Stock 10.00044g / 500mL UMESC well water (20°C)

Additional information:

Witness and form recorded by:

Kerry L Weber	[redacted]	UMESC	16MAY12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 9
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Title: **"Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"**

Study number: AEH-11-PSEUDO-02

File Folder: 15b Lab book/pgs: 3/13 Reviewed: [illegible] Verified: [illegible] 11-21-14

Newly Metamorphosed Mussel Exposure Dosing Form

Species: HGE **UMESC lot number:** 121900

Test System Assignment (circle one): 1 2 3

Number mussel/Chamber 40 **Number of replicate Chambers/Concentration** 4

Number of Concentrations (including control) 6

Date/time (military) of dosing initiation: ~~5/29/12~~ 5/26/12 / 0923 wrong date TMS 5/26/12

Date/time (military) of dosing completion: 5/26/12 / 0949

Chemical Lot : TR 4669-4-(5) **Stock Chemical Sample I.D.** Deactive (HD Stock) Active Stock

Test Solution Preparation Time: 0923 - 0945

Test Solution preparation description (include dilution volume):

HD stock 10.00374g / 500 mL UMESC well water heated at 70°C for 45 min

Active Stock 10.00365g / 500 mL UMESC well water (20°C)

Additional information:

Witness and form recorded by:

Therese Schreier	[redacted]	UMESC	5/26/12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 15b
Item No. 10
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Number AEH-11-PSEUDO-02

Approved by: [redacted] Date 6/24/11
File Folder: 15[redacted]
Version: 1.1/24JU[redacted]2011

Log Book / Pages 2/8
File Folder 15
Initials KLW Date 27JUL11

Proofed: TJS 19JAN12 Reviewed: JRL 11-21-14

Chemical Stock Solution Determination

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 100% active ingredient[10mg/mL]) *** Make 5g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [10mg/ml]***Make 5g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use

Dosage Level (mg/L)	Dose concentration	Test solution Stock volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Aliquot Stock A (mL)	Aliquot Stock B (mL)	Aliquot Stock C (mL)	Color Code Assignment
0	control (well water blank)	5,000	0	0	0	0.0	0.0	0.0	White
300	mg/L (Deactivated)	5,000	1,500	1500	0	0.0	0.0	150.0	White/black stripes
50	mg/L	5,000	250	0	250	0.0	25.0	0.0	Yellow
100	mg/L	5,000	500	0	500	0.0	50.0	0.0	Yellow/black stripes
200	mg/L	5,000	1,000	0	1000	0.0	100.0	0.0	Blue
300	mg/L	5,000	1,500	0	1500	0.0	150.0	0.0	Blue/black stripes
Total						0.0	325.0	150.0	

Dosing of O. olivaria on 12 JUL 2011. (Added by KLW 27JUL11)

Concentration	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Intialis	Date
0 mg/L	1004	1004	1008	PLM	1046	KLW	7/13/2011
300 mg/L Deactive	1006	1008	1013	PLM	① ~~15~~ 1050	JRL	7/13/11
50 mg/L	1010	1013	1017	PLM	1054	KLW	7/13/11
100 mg/L	1014	1018	1022	PLM	1057	KLW	7/13/11
200 mg/L	1019	1022	1027	PLM	1059	KLW	7/13/11
300 mg/L Active	1025	1028	1032	PLM	1102	KLW	7/13/11

① wrote wrong time 7-13-11 JRL

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Item No. 4
Pg 1 of 1

Study Number AEH-11-PSEUDO-02

Approved by: [redacted]
File Folder: 15 [redacted] /
Version: 1.1/24JUNE2011

Date 6/24/11

Log Book / Pages 2/14
File Folder 15
Initials KLW Date 27 JUL 11

Proofed: RS 19JAN12 Reviewed: JRL 11-21-14

Chemical Stock Solution Determination

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 100% active ingredient[10mg/mL]) *** Make 5g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [10mg/mL]***Make 5g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use

Dosage Level (mg/L)	Dose concentration	Test solution Stock volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Aliquot Stock A (mL)	Aliquot Stock B (mL)	Aliquot Stock C (mL)	Color Code Assignment
0	control (well water blank)	5,000	0	0	0	0.0	0.0	0.0	White
300	mg/L (Deactivated)	5,000	1,500	1500	0	0.0	0.0	150.0	White/black stripes
50	mg/L	5,000	250	0	250	0.0	25.0	0.0	Yellow
100	mg/L	5,000	500	0	500	0.0	50.0	0.0	Yellow/black stripes
200	mg/L	5,000	1,000	0	1000	0.0	100.0	0.0	Blue
300	mg/L	5,000	1,500	0	1500	0.0	150.0	0.0	Blue/black stripes
Total						0.0	325.0	150.0	

Dosing of A. liganentina on 14 JUL 2011. (Added by KLW 27 JUL 11).

Concentration	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Intiails	Date
0 mg/L	0910	0912	0916	JTV	0930 - 0950	JRL	7-15-11
300 mg/L Deactive	0915	0916	0919	JTV	0935 - 0950	JRL	7-15-11
50 mg/L	0918	0920	0924	JTV	0935 - 0950	JRL	7-15-11
100 mg/l	0921	0924	0927	JTV	0935 - 0950	JRL	7-15-11
200 mg/L	0925	0928	0931	JTV	0935 - 0950	JRL	7-15-11
300 mg/L Active	0929	0931	0935	JTV	0935 - 0950	JRL	7-15-11

FF # 15
Item No. 5
Pg 1 of 1

Study Number AEH-11-PSEUDO-02

Approved by: [redacted] Date 6/24/11
File Folder: 15 [redacted]
Version: 1.1/24JUNE2011 Lab notebook: 2 pages: 26-27 KLW 14DEC11

Proofed: TJS 19JAN12 Reviewed: JAW 11-21-14

FF # 15
Item No. 6 of 1
Pg

Chemical Stock Solution Determination

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 100% active ingredient[10mg/mL]; *** Make 5g/500 mL well water per each test system
Stock C = 10,000 mg/l detoxified active material [10mg/mL]***Make 5g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use

Dosage Level (mg/L)	Dose concentration	Test solution Stock volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Aliquot Stock A (mL)	Aliquot Stock B (mL)	Aliquot Stock C (mL)	Color Code Assignment
0	control (well water blank)	5,000	0	0	0	0.0	0.0	0.0	White
300	mg/L (Deactivated)	5,000	1,500	1500	0	0.0	0.0	150.0	White/black stripes
50	mg/L	5,000	250	0	250	0.0	25.0	0.0	Yellow
100	mg/L	5,000	500	0	500	0.0	50.0	0.0	Yellow/black stripes
200	mg/L	5,000	1,000	0	1000	0.0	100.0	0.0	Blue
300	mg/L	5,000	1,500	0	1500	0.0	150.0	0.0	Blue/black stripes
Total						0.0	325.0	150.0	

Concentration	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Intiails	Date
0 mg/L	0900	0900	0907	SStaf	0926	KLW	14DEC11
300 mg/L Deactive	0905 ~0925 ①	0908 ~0928 ①	0912 ~0932 ①	SStaf	0932	↑	↑
50 mg/L	0910 ~0930 ①	0913 ~0930 ①	0917 ~0934 ①	SStaf	0936		
100 mg/L	0915	0922	0926	SStaf	0928		
200 mg/L	0930	0932	0936	SStaf	0939	↓	↓
300 mg/L Active	0934	0937	0940	SStaf	0943	KLW	14DEC11

① These concentrations were incorrectly made by using less dilution water than necessary. 3,500 mL was used for the 300 H.D. instead of 4,850 mL and 4,750 mL was used for the 50 mg/L instead of 4,975 mL. When this was realized after the 50 mg/L was dosed, the stocks were remade correctly, the chambers were flushed with the correct stock and re-dosed. The incorrect dose was in the 300 H.D. chambers for ± 20 minutes and in the 50 mg/L for ± 17 minutes. A deviation will be drafted to document this error. 12-13-11 JAW

Study Number AEH-11-PSEUDO-02
Reviewed: TJS 31JAN12
Verified: JAL 11/21/14

File Folder: 15
Lab book/pgs: 2| 33-34
Species: FHM
System: 1
Date of Dosing: 27 JAN 12
Formulation and lot #: MBI-401 SDP 465-12-Mix

FF # 15
Item No. 7
Pg 1 of 1

Chemical Stock Solution Determination and Preparation

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 50% active ingredient[20mg/mL]) *** Make 10g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [20mg/mL]***Make 10g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use
Dilution water = 20°C UMESC Well Water

Dose Level (mg/L)	Final Solution Volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Dilution water to add to container (mL)	*Well Water* Aliquot Stock A (mL)	*Active Stock* Aliquot Stock B (mL)	*Deactive Stock* Aliquot Stock C (mL)	Color Code Assignment
0	5,000	0	0	0	0	5000.0	0.0	0.0	White
300 HD	5,000	1,500	1500	0	4,850	0.0	0.0	150.0	White/black stripes
50	5,000	250	0	250	4,975	0.0	25.0	0.0	Yellow
100	5,000	500	0	500	4,950	0.0	50.0	0.0	Yellow/black stripes
200	5,000	1,000	0	1000	4,900	0.0	100.0	0.0	Blue
300 Active	5,000	1,500	0	1500	4,850	0.0	150.0	0.0	Blue/black stripes
Total						5000.0	5000.0	325.0	150.0

	A	B	C	D	E	F	G
Concentration (mg/L)	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Initials/Date	Date
0	1008	1009	1013	SStaf	1020 to 1030	KLW 28JAN12	27JAN12*
300 HD	1010	1013	1017	SStaf	1020 to 1030		
50	1015	1018	1021	SStaf	1020 to 1030		
100	1019	1022	1026	SStaf	1020 to 1030		
200	1023	1026	1030	SStaf	1020 to 1030		
300 Active	1028	1031	1035	SStaf	1020 to 1030	KLW/28JAN12	27JAN12

*This date corresponds with data found on Columns A, B, C, and D. KLW 27 JAN12

This datasheet was approved b[redacted] on 15 Jan 2012.
11JAN2012/version1.2

Study Number AEH-11-PSEUDO-02
Reviewed: TJS 23APR12
Verified: Snc 11/21/14

File Folder: 15 wrong page 18APR12
Lab book/pgs: 2134-40-42
Species: BLS
System: 2
Date of Dosing: 17APR12
Formulation and lot #: MBI-401 SDP TR4669-4-(7-8) (2nd shipment)

FF # 15
Item No. 8
Pg 1 of 1

Chemical Stock Solution Determination and Preparation

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 50% active ingredient[20mg/mL]) *** Make 10g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [20mg/mL]***Make 10g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use
Dilution water = 20°C UMESC Well Water

Dose Level (mg/L)	Final Solution Volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Dilution water to add to container (mL)	*Well Water* Aliquot Stock A (mL)	*Active Stock* Aliquot Stock B (mL)	*Deactive Stock* Aliquot Stock C (mL)	Color Code Assignment
0	5,000	0	0	0	0	5000.0	0.0	0.0	White
300 HD	5,000	1,500	1500	0	4,850	0.0	0.0	150.0	White/black stripes
50	5,000	250	0	250	4,975	0.0	25.0	0.0	Yellow
100	5,000	500	0	500	4,950	0.0	50.0	0.0	Yellow/black stripes
200	5,000	1,000	0	1000	4,900	0.0	100.0	0.0	Blue
300 Active	5,000	1,500	0	1500	4,850	0.0	150.0	0.0	Blue/black stripes
Total						5000.0	5000.0	325.0	150.0

Concentration (mg/L)	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Initials	Date
0	0910	0910	0913	4/17/12 TMS	0919	JAL	4/18/12
300 HD	0913	0914	0918	4/17/12 TMS	0949 ~~0925~~ 0950	JAL	4/18/12
50	0916	0920	0923	4/17/12 TMS	KW 18APR12 ~~093~~ 0925	JAL	4/18/12
100	0922	0925	0929	4/17/12 TMS	0932	KW	4/18/12
200	0927	0931	0935	4/17/12 TMS	0938	KW	4/18/12
300 Active	0933	0936	0940	4/17/12 TMS	0943	KW	4/18/12

Wrong times KW 18APR12
wrote in wrong row

This datasheet was approved b[redacted] on 19JAN2012.
11JAN2012/version1.2

Study Number AEH-11-PSEUDO-02
Reviewed: KLW 17MAY12
Verified: JBL 11/24/14

File Folder: 15
Lab book/pgs: 2/47
Species: Plain Pocket book
System: 1
Date of Dosing: 5/16/12
Formulation and lot #: MBI-401 SDP TR4669-4-(5)

FF # 15
Item No. 9
Pg 1 of 1

Chemical Stock Solution Determination and Preparation

Stock A = Control (20 °C well water -controls will be treated in the same manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 50% active ingredient[20mg/mL]) *** Make 10g/500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [20mg/mL]***Make 10g/500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use
Dilution water = 20°C UMESC Well Water

Dose Level (mg/L)	Final Solution Volume (mL)	mg of test material required	Deactivated mg required	Active mg required	Dilution water to add to container (mL)	*Well Water* Aliquot Stock A (mL)	*Active Stock* Aliquot Stock B (mL)	*Deactive Stock* Aliquot Stock C (mL)	Color Code Assignment
0	5,000	0	0	0	0	5000.0	0.0	0.0	White
300 HD	5,000	1,500	1500	0	4,850	0.0	0.0	150.0	White/black stripes
50	5,000	250	0	250	4,975	0.0	25.0	0.0	Yellow
100	5,000	500	0	500	4,950	0.0	50.0	0.0	Yellow/black stripes
200	5,000	1,000	0	1000	4,900	0.0	100.0	0.0	Blue
300 Active	5,000	1,500	0	1500	4,850	0.0	150.0	0.0	Blue/black stripes
Total						5000.0	5000.0	325.0	150.0

Water stopped to system at 0945. KLW 16MAY12

Concentration (mg/L)	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Initials	Date
0	0945	0945	0950	TMS	0952	17MAY12	KLW
300 HD	0950	0951	0953	TMS	0955	↑	↑
50	0952	0956	0958	TMS	0958		
100	0957	1000	1004	TMS	1001		
200	1003	1006	1010	TMS	1004	↓	↓
300 Active	1009	1012	1016	TMS	1007	17MAY12	KLW

This datasheet was approved b[redacted] on 19JAN2012.
11JAN2012/version1.2

Study Number AEH-11-PSEUDO-02
Reviewed: KWW [illegible]
Verified: Jn 11/21/14

File Folder: 15a
Lab book/pgs: 3/1-5
Species: HGE
System: 1
Date of Dosing: 5/26/12
Formulation and lot #: SDP TR 4669-4-(5)

FF # 15
Item No. 10
Pg 1 of 1

Chemical Stock Solution Determination and Preparatir r

Stock A = Control (20 °C well water -controls will be treated in the sam manner but will use a stock solution of plain well water)
Stock B = 10,000 mg/L; 50% active ingredient[20mg/mL]) *** Make 10 500 mL well water per each test system
Stock C = 10,000 mg/L detoxified active material [20mg/mL]***Make 1 /500 mL well for use in all 3 systems - Heat deactivated for 45 minutes at 70°C/cooled to 20 °C prior to use
Dilution water = 20°C UMESC Well Water

Dose Level (mg/L)	Final Solution Volume (mL)	mg of test material required	Deactivated n required	Active mg required	Dilution water to add to container (mL)	*Well Water* Aliquot Stock A (mL)	*Active Stock* Aliquot Stock B (mL)	*Deactive Stock* Aliquot Stock C (mL)	Color Code Assignment
0	5,000	0	0	0	0	5000.0	0.0	0.0	White
300 HD	5,000	1,500	1500	0	4,850	0.0	0.0	150.0	White/black stripes
50	5,000	250	0	250	4,975	0.0	25.0	0.0	Yellow
100	5,000	500	0	500	4,950	0.0	50.0	0.0	Yellow/black stripes
200	5,000	1,000	0	1000	4,900	0.0	100.0	0.0	Blue
300 Active	5,000	1,500	0	1500	4,850	0.0	150.0	0.0	Blue/black stripes
Total						5000.0	5000.0	325.0	150.0

Concentration (mg/L)	Time Test Solution Prepared	Time Dosing Started	Time Dosing Completed	Initials	Time of Exposure Termination	Initials	Date
0	0923	0923	0926	TMS	0935	TMS	5/27/12
300 HD	0925	0926	0930	TMS	0938	TMS	5/27/12
50	0928	0931	0935	TMS	0942	TMS	5/27/12
100	0932	0935	0939	TMS	0945	TMS	5/27/12
200	0937	0940	0944	TMS	0953	TMS	5/27/12
300 Active	0942	0945	0949	TMS	0951	TMS	5/27/12

5/26/12 TMS

This datasheet was approved b[redacted] on 19 ~2012.
11JAN2012/version1.2

AEH-11-PSEUDO-02

CHEMICAL LOG BOOK

MBI-401 FDP

FF # 8
Item No. 4
Pg 1 of 6

Manufacturer:

Marrone Bio Innovations (MBI)
Davis, California

Lot Number
110510FD

SIGNATURE PAGE

All personnel making an entry in this log must fill out the form below in accordance with SOP GEN 009.

PRINTED NAME	SIGNATURE	INITIALS	DATE
Kerry L. Weber	[redacted]	KLW	6/28/11
JAMES A. Lum		JAL	7/5/11
Therese Schreier		TMS	7/9/12

"This Use and Maintenance Log Book has been inspected and found to be in compliance with SOP GEN 009.

Inspected and sealed on Jul 5 2011 by [redacted] ."

Date Quality Assurance Unit

Shipped 06/13/2011
Received 06/14/2011

Marrone Bio Innovations

CERTIFICATE OF ANALYSIS

AEH-11-PSEUDO-02

Test Material:	MBI-401 FDP
Lot Number:	110510FD
Concentration:	100 % *Pseudomonas fluorescens* strain CL145A
Pf CL145A CFUs/g:	0
Mussel Bioassay:	PASS
Appearance:	Tan powder
Storage Conditions:	4C
Date of Manufacture:	5/14/11
Expiration Date:	3 months from date of manufacture

Analyst: [redacted] Date: 6/14/11

Page 3 of 6

2121 Second Street, Suite B-107 • Davis, CA 95618 • Phone: 530-750-2800

Zequanox Freeze Dried Powder - Material Specification Sheet

AEH-11-PSEUDO-02

Prepared By:

Denise Mayer
New York State Museum
Field Research Laboratory
51 Fish Hatchery Road
Cambridge, NY 12816
(518) 677-8245

Shipped to:

Attn: Jim Luoma
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Rd.
LaCrosse, WI 54603
(608)783-6451

Shipment Date:
6/27/11

Storage Information:
Store below 4C at all times.

Material Specs:
Material Lot#: **110510FD**
Formulation: FDP
Dry Cell Weight: 100% (by weight of powder)
Volume per Aliquot: 75g (= 75 g active ingredient)
Number of Aliquots: 1

Page 4 of 6

TEST CHEMICAL DATA FORM

Test Material (Chemical Name) CL145A Strain of Pseudomonas fluorescens

Trade Name of Chemical (Synonyms) MBI-401 FDP

Source of Chemical (Manufacturer) Marrone Bio Innovations (MBI)

Storage Location Room 122 Hotpoint Refrigerator in lockbox

Date Received 28 JUN 2011 Date Opened 28 JUN 2011 Expiration Date 14 AUG 2011
(5 years unless otherwise stated)

Test Chemical Lot Number 110510FD Purity of Chemical 100%

Amount of Test Chemical Available or Received (if known) 75g (75.52g)

Initial Weight (with cover on) of Test Chemical and Container 136.77g

Characterization of Test Chemical: Color Tan
Physical State: liquid ☐ solid ☒
Solid Form: powder ☒ crystal ☐ pellet ☐

Chemical Abstract Service Number N/A

Manufacturer Certificate of Analysis Yes ☒ No ☐

Additional Comments About Test Chemical:
Temperature in cooler was 14°C upon receipt. Temperature in container with Pf-CL145A was 9°C.

Sample Placed in Archives: Yes ☒ No ☐ (Entries should also be made on Form GEN 012.2b)

Archive # R/III/F-7 Material Safety Data Sheet Available: Yes ☒ No ☐

[redacted] 6/5/2011

Signature of person (Study Director or designated representative) initiating Test Chemical Use Log and date:

Page 5 of 6

Signature [redacted] Date 28 JUN 2011

FF # 8
Item No. 4
Pg 6 of 6

ORIGINAL

TEST CHEMICAL USE LOG

Test Chemical: MBI-401 FDP Manufacturer: MBI Lot #: 110510FD

A Initial weight of chemical & container (with cap/lid on) (g)	B Amount removed (g)	C Weight of chemical & container (g) after removal (with cap/lid on)	D Study # and Purpose	E Comments	F Date Initials
136.77	1.06216	135.68	*Archived AEH-11-PSEUDO-02 Sample	Archiving Sample	KLW 28 JUN 2011
135.68	5.0082	130.67	AEH-11-PSEUDO-02	Deactive Test Chemical (HIC species)	KLW 12 JUL 2011
130.67	5.0076	125.66	AEH-11-PSEUDO-02	Active Test Chemical (HIC species)	KLW 12 JUL 2011
125.67	5.0010	120.67	AEH-11-PSEUDO-02	Deactive Test Chemical (MUC species)	KLW 14 JUL 2011
120.67	5.0012	115.68	AEH-11-PSEUDO-02	Active Test Chemical (MUS species)	KLW 14 JUL 2011
115.74	5.3778	110.36	AEH-11-PSEUDO-02	Sample to New York State Museum for analysis	KLW 19 JUL 2011
① 110.61				Final weight for disposal	7/9/12 pms
Logbook	Closed	test	chemical	disposed pms 7/9/12	

① Verified by [redacted] 7/9/12

* The first entry should be the chemical placed in the Chemical Archives. Follow GEN 011.
* The initial weight is also entered on Form GEN 012.2a.

A The weight of the chemical and its container shall be measured by weighing it on a balance that has been verified to be accurate (SOP GEN 013).
B The chemical removed from the test chemical container will be weighed into a tared vessel.
C After the chemical has been removed from the test chemical container, reweigh the container and its contents (including the cap or

AEH-11-PSEUDO-02

CHEMICAL LOG BOOK

MBI-401 FDP

Marrone Bio Innovations
Davis, California

LOT NUMBER: 110928FD

FF # 8
Item No. 5
Pg 1 of 5

AEH-11-PSEUDO-02

SIGNATURE PAGE

All personnel making an entry in this log must fill out the form below in accordance with SOP GEN 009.

PRINTED NAME	SIGNATURE	INITIALS	DATE
Kerry L. Weber	[redacted]	KLW	8 Dec 11
Theresa Schreier		TMS	7/9/12

"This Use and Maintenance Log Book has been inspected and found to be in compliance with SOP GEN 009.

Inspected and sealed on December 9 (Date) by [redacted] (Quality Assurance Unit)."

Page 2 of 5

Marrone Bio Innovations

AEH-11-PSEUDO-02

CERTIFICATE OF ANALYSIS

Name of Product:	MBI-401 FDP
Active Ingredient:	100% *Pseudomonas fluorescens* strain CL145A cells and spent fermentation media
Cfu/g:	0 cfu/g *Pseudomonas fluorescens* strain CL145A
Lot Number:	110928FD
Mussel Bioassay:	Pass
Appearance:	Tan powder
Storage Conditions:	4 °C, in the dark
Date of Manufacture:	18 OCT 2011
Expiration Date:	This product is stable for 6 months from date of manufacture provided the sample is stored under the recommended storage conditions.

I hereby certify that the above information is true and correct.

Quality Control: [redacted]
Tamara Nicholson, Quality Control Supervisor

Date: 28 NOV 2011

2121 Second Street, Suite B-107 • Davis, CA 95618 • Phone: 530-750-2800

TEST CHEMICAL DATA FORM

Test Material (Chemical Name) MBI-401 FDP

Trade Name of Chemical (Synonyms) PF-CL145A; Zequanox

Source of Chemical (Manufacturer) Marrone Bio Innovations

Storage Location Refrigerator in Rm 122 in lockbox (4°C)

Date Received 6 DEC 11 Date Opened 8 DEC 11 Expiration Date 18 MAR 2012
(5 years unless otherwise stated)

Test Chemical Lot Number 110928FD Purity of Chemical 100%

Amount of Test Chemical Available or Received (if known) 100g

Initial Weight (with cover on) of Test Chemical and Container 161.362g

Characterization of Test Chemical: Color TAN
Physical State: liquid ☐ solid ☒
Solid Form: powder ☒ crystal ☐ pellet ☐

Chemical Abstract Service Number N/A

Manufacturer Certificate of Analysis Yes ☒ No ☐

Page 4 **of** 5

Additional Comments About Test Chemical:
Temperature in cooler was 2.0°C upon receipt.

Sample Placed in Archives: Yes ☒ No ☐ (Entries should also be made on Form GEN 012.2b)
JER 12/7/2011

Archive # B-III-10 Material Safety Data Sheet Available: Yes ☒ No ☐

Signature of person (Study Director or designated representative) initiating Test Chemical Use Log and date:

Signature [redacted] Date 8 DEC 11

FF # 8
Item No. 3
Pg 5 of 3

ORIGINAL

TEST CHEMICAL USE LOG

Test Chemical: MBI - 401 FDP   Manufacturer: MBI   Lot #: 110928FD

A Initial weight of chemical & container (with cap/lid on)(g)	B Amount removed (g)	C Weight of chemical & container (g) after removal (with cap/lid on)	D Study # and Purpose	E Comments	F Date/Initials
*: 161.362	* 1.14497	* 160.194	*Archived Sample	AEH-11-PSEUDO-02	KLW 8 DEC 11
160.228	5.0055	155.209		AEH-11-PSEUDO-02 was Deactive stock	KLW 13 DEC 11
155.209	5.0078	150.202		AEH-11-PSEUDO-02 was Active stock	KLW 13 DEC 11
150.254	5.4016	144.782		AEH-11-PSEUDO-02 Sample to NYSH for verification	KLW 13 DEC 11
(1) 145.20	—	—		Final weight for disposal	7/9/12
Logbook closed - test chemical disposed TMS 7/9/12					

(1) Verified by [redacted] QAO 7/9/12
* The first entry should be the chemical placed in the Chemical Archives. Follow GEN 011.
‡ • The initial weight is also entered on Form GEN 012.2a.

A. The weight of the chemical and its container shall be measured by weighing it on a balance that has been verified to be accurate (SOP GEN 013).
B. The chemical removed from the test chemical container will be weighed into a tared vessel.
C. After the chemical has been removed from the test chemical container, reweigh the container and its contents (including the cap or

AEH-11-PSEUDO-02

CHEMICAL LOG BOOK

MBI-401 SDP

Marrone Bio Innovations
Davis, California

LOT NUMBER: MBI-401 SDP 4655-12-Mix

FF # 8
Item No. 6
Pg 1 of 5

SIGNATURE PAGE

All personnel making an entry in this log must fill out the form below in accordance with SOP GEN 009.

PRINTED NAME	SIGNATURE	INITIALS	DATE
Kerry L. Weber	[redacted]	Klw	10JAN12
Theresa Schreier		Tms	7/9/12

"This Use and Maintenance Log Book has been inspected [redacted] with SOP GEN 009.

Inspected and sealed on 10 January 2012 by [redacted]."
Date — Quality Assurance Unit

Page 2 of 5

Form GEN 012.3a
Page 1 of 1

TEST CHEMICAL DATA FORM

Test Chemical (Chemical Name) MBI-401 SDP

Circle one: Test Article Control Article

Trade Name of Test Chemical (Synonyms) Pf-CL145A; Zequanox

Source of Test Chemical (Manufacturer) Marrone Bio Innovations

Storage Location Refrigerator in Rm 122 in lockbox (0-5°C)

Date Received 10 JAN 2012 Date Opened 10 JAN 2012 Expiration Date 10 JAN 2017
(5 years unless otherwise stated) (None provid

Test Chemical Lot Number MBI-401 SDP 4655-12-Mix Purity of Chemical 50%

Amount of Test Chemical Available or Received (if known) 100g

Initial Mass (with cover on) of Test Chemical and Container 162.057 g

Characterization of Test Chemical: Color Tan
Physical State: liquid __ solid X
Solid Form: powder X crystal __ pellet __

Chemical Abstract Service Number N/A

Manufacturer Certificate of Analysis Yes __ No X

Additional Comments about the Test Chemical:
Temperature in cooler upon receipt was 3.1°C.

Sample Placed in Archives: Yes X No __ (Entries should also be made on Form GEN 012.b)

Archive Location RF III-F11 Material Safety Data Sheet Available: Yes X No __

Signature of Study Director or designee initiating Test Chemical Use Log and date:

Signature [redacted] Date 10 JAN 2012

Page 3 of 5

ORIGINAL

TEST CHEMICAL USE LOG

Test Chemical: PF-CH45A/MBI-401 SDF/ Zequanox | Manufacturer: Marrone Bio Innovations (MBI) | Lot or Batch #: MBI-401 SDP 4655-12-Mix

A Initial mass of test chemical & container with cap/ lid on (g)	B Amount removed (g)	C Mass of test chemical & container after removal, with cap/lid on (g)	D Study Number	E Purpose and Other Comments	F Date	G Initials
*1 162.057	* 4.5436	* 157.404	AEH-11-PSEUDO-01	*Archived Sample	10 JAN 12	KLW
157.413	2.0013	155.359	AEH-11-PSEUDO-01	Heat deactive test chemical for BCS and MUC	17 JAN 12	KLW
155.359	2.0037	153.339	AEH-11-PSEUDO-01	Test chemical for BCS	17 JAN 12	KLW
153.339	2.0020	151.300	AEH-11-PSEUDO-01	Test chemical for MUC	17 JAN 12	KLW
151.375	2.0002	149.338	AEH-11-PSEUDO-01	Heat deactive test chemical for HIC	19 JAN 12	KLW
149.338	2.0014	147.386	AEH-11-PSEUDO-01	Test chemical for HIC	19 JAN 12	KLW
147.287	10.0553	137.150	AEH-11-PSEUDO-03	Heat deactive test chemical for FAM	27 JAN 12	KLW
137.150	10.0406	126.969	AEH-11-PSEUDO-03	Active Test Chemical for FAM	27 JAN 12	KLW
126.979	5.1433	121.801	AEH-11-PSEUDO-01 AEH-11-PSEUDO-03	Test chemical to WYSM for analysis	31 JAN 12	KLW
① 122.30	———	———		Final weight before disposal	7/9/12	TMS

* = The first entry should be the test chemical sample placed in the Chemical Archives. Follow GEN 011.
1 = The initial mass is also entered on Form GEN 012.a.
A. The mass of the test chemical and its container will be determined using a balance that has been verified to be accurate (SOP GEN 013).
B. The test chemical removed from the container will be placed into a tared vessel.
C. After the test chemical has been removed from the container, determine the mass of the container and its contents (with cap/lid on).

① Clarified by [redacted] QAO 7/9/12

AEH-11-PSEUDO-02

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ORIGINAL

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Form GEN 012.3c
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TEST CHEMICAL USE LOG

Test Chemical: MBI-401 SDP			Manufacturer: MBI	Lot or Batch #: MBI-401 SDP 4655-12-Mix		
A	B	C	D	E	F	G
Initial mass of test chemical & container with cap/ lid on (g)	Amount removed (g)	Mass of test chemical & container after removal, with cap/lid on (g)	Study Number	Purpose and Other Comments	Date	Initials
Logbook	closed	test	chemical	disposed PMS	7/9/12	

A. The mass of the test chemical and its container will be determined using a balance that has been verified to be accurate (SOP GEN 013).
B. The test chemical removed from the container will be placed into a tared vessel.
C. After the test chemical has been removed from the container, determine the mass of the container and its contents (with cap/lid on).

AEH-11-PSEUDO-02

AEH-11-PSEUDO-02

CHEMICAL LOG BOOK

MBI-401 SDP

Marrone Bio Innovations
Davis, California

LOT NUMBER: TR4669-4-(7-8)

Container 1 of 3

(Shipment #2 KW 13MAR12)

FF # 8
Item No. 7
Pg 1 of 5

SIGNATURE PAGE

All personnel making an entry in this log must fill out the form below in accordance with SOP GEN 009.

PRINTED NAME	SIGNATURE	INITIALS	DATE
Todd J. Severson	[redacted]	TJS	13MAR12
Kerry L. Weber		KLW	13MAR12

"This Use and Maintenance Log Book has been inspected [redacted]th SOP GEN 009.

Inspected and sealed on March 28 2012 by [redacted] ."
Date Quality Assurance Unit

Page 2 of 5

Marrone™ Bio Innovations

AEH-11-PSEUDO-02

CERTIFICATE OF ANALYSIS

Name of Product:	MBI-401 SDP
Active Ingredient:	100% *Pseudomonas fluorescens* strain CL145A cells and spent fermentation media
Percent Active Ingredient:	50% by weight
Viable Cfu/g:	0 cfu/g *Pseudomonas fluorescens* strain CL145A
Lot Number:	TR 4669-4-(7-8)
Mussel Bioassay:	Pass
Appearance:	Tan powder
Storage Conditions:	4 °C, protected from light
Date of Manufacture:	26 January 2012
Expiration Date:	1 year from date of manufacture

I hereby certify that the above information is true and correct.

Quality Control: [redacted]
Tamara Nicholson, Quality Control Supervisor

Date: 13 February 2012

Page 3 of 5

2121 Second Street, Suite B-107 • Davis, CA 95618 • Phone: 530-750-2800

Form GEN 012.3a
Page 1 of 1

TEST CHEMICAL DATA FORM

Test Chemical (Chemical Name) MBI-401 SDP

Circle one: Test Article Control Article

Trade Name of Test Chemical (Synonyms) Pf-CL 145A; Zequanox

Source of Test Chemical (Manufacturer) Marrone Bio Innovations

Storage Location Refrigerator in Room 2

Date Received 13MAR12 Date Opened 13MAR12 TRS Expiration Date 26JAN13
(5 years unless otherwise stated)

Test Chemical Lot Number ① TR 4669-4-(7-8) Purity of Chemical 50%

Amount of Test Chemical Available or Received (if known) ~1.63 kg

Initial Mass (with cover on) of Test Chemical and Container 1714.38g

Characterization of Test Chemical: Color Tan
Physical State: liquid __ solid x
Solid Form: powder x crystal __ pellet __

Chemical Abstract Service Number N/A

Manufacturer Certificate of Analysis Yes X No __

Additional Comments about the Test Chemical:

① This is the second shipment of this lot. KW 13MAR12
② This archive sample is from container 1 of 3 of shipment received on 6MAR12. KW 13MAR12

Sample Placed in Archives: Yes X No __ (Entries should also be made on Form GEN 012.b)

Archive Location ② RF-III-6-6 Material Safety Data Sheet Available: Yes X No __

Signature of Study Director or designee initiating Test Chemical Use Log and date:

Signature [redacted] Date 13MAR12

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ORIGINAL

SOP No. GEN 012.3
Page 6 of 7

Form GEN 012.3b.
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TEST CHEMICAL USE LOG

Test Chemical: MBI-401 SDP		Manufacturer: Marrone Bio Innovations		Lot or Batch #: TR 4669-4-(7-5)		
A	B	C	D	E	F	G
Initial mass of test chemical & container with cap/ lid on (g)	Amount removed (g)	Mass of test chemical & container after removal, with cap/lid on (g)	Study Number	Purpose and Other Comments	Date	Initials
*1 Sample archived	* from	* container 1of	3 of shipment	*Archived Sample #1 (received 6MAR12) KW 13MAR12		
1714.35	2.00073	1712.32	AEH-12-PSEUDO-03	Analytical Stock #1 for BLG	2APR12	KW
1712.32	2.00044	1710.31	AEH-12-PSEUDO-03	Analytical Stock #2 for BLG	2APR12	KW
1710.31	720.00	990.23	AEH-12-PSEUDO-03	Stock #1 for BLG	2APR12	KW
990.23	720.01	270.15	AEH-12-PSEUDO-03	Stock #2 for BLG	2APR12	KW
270.27	10.00034	260.04	AEH-11-PSEUDO-02	Inactive Stock for BLS	16APR12	KW
260.04	10.00418	249.99	AEH-11-PSEUDO-02	Active Stock for BLS	16APR12	KW
250.08	145.00	104.97	AEH-11-PSEUDO-02 AEH-12-PSEUDO-03	Remaining test chemical weighed into tared baggie, original container with residue weighed. All returned to NYSM.	19APR12	KW
			Chemical and container returned to NYSM	for archiving. KW 19APR12		

* = The first entry should be the test chemical sample placed in the Chemical Archives. Follow GEN 011.
1 = The initial mass is also entered on Form GEN 012.a.
A. The mass of the test chemical and its container will be determined using a balance that has been verified to be accurate (SOP GEN 013).
B. The test chemical removed from the container will be placed into a tared vessel.
C. After the test chemical has been removed from the container, determine the mass of the container and its contents (with cap/lid on).

AEH-11-PSEUDO-02

AEH-11-PSEUDO-02

CHEMICAL LOG BOOK

MBI-401 SDP

Marrone Bio Innovations
Davis, California

LOT NUMBER: TR 4669-4-(5)

Container 1

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Item No. 8
Pg 1 of 7

SIGNATURE PAGE

All personnel making an entry in this log must fill out the form below in accordance with SOP GEN 009.

PRINTED NAME	SIGNATURE	INITIALS	DATE
Kevin L. Weber	[redacted]	KLW	24Apr12
Theresa M. Schreier		TMS	5/25/12

"This Use and Maintenance Log Book has been inspected and found to be in compliance with SOP GEN 009.

Inspected and sealed on 01 May 2012 by [redacted]."

Date — Quality Assurance Unit

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Marrone™ Bio Innovations

CERTIFICATE OF ANALYSIS

Name of Product:	MBI-401 SDP
Active Ingredient:	100% *Pseudomonas fluorescens* strain CL145A cells and spent fermentation media
Percent Active Ingredient:	50% by weight
Viable Cfu/g:	0 cfu/g *Pseudomonas fluorescens* strain CL145A
Lot Number:	TR 4669-4-(5)
Mussel Bioassay:	Pass
Appearance:	Tan powder
Storage Conditions:	4 °C, protected from light
Date of Manufacture:	12 January 2012
Expiration Date:	1 year from date of manufacture

I hereby certify that the above information is true and correct.

Quality Control: [redacted] Date: 12 March 2012

Tamara Nicholson, Quality Control Supervisor

2121 Second Street, Suite B-107 • Davis, CA 95618 • Phone: 530-750-2800

THE STATE EDUCATION DEPARTMENT / OFFICE OF CULTURAL EDUCATION

New York State Museum Field Research Laboratory
51 Fish Hatchery Road
Cambridge, NY 12816
Tel. 518-677-8245
Fax 518-677-5236
E-mail: dmayer@mail.nysed.gov

AEH-11-PSEUDO-02

PACKING LIST
DATE OF SHIPMENT - 2012/04/23

Ship from:
Denise Mayer
New York State Museum
Field Research Laboratory
51 Fish Hatchery Road
Cambridge, NY 12816

Ship To:
Jim Luoma
USGS UMESC
2630 Fanta Reed Road
La Crosse, WI 54603

Shipping Method: UPS Next Day Air
Required by: 2012/04/24

Item Description:

MBI-401 SDP Lot # TR-4669-4-(5) in one bag, bag #1 (total weight 5 Kg):

Shipped on ice. Store at 4°C, protected from light.

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ORIGINAL

SOP No. GEN 012.2
Page 5 of 6

Form GEN 012.2a
Page 1 of 1

TEST CHEMICAL DATA FORM

Test Material (Chemical Name) MBI-401 SDP

Trade Name of Chemical (Synonyms) Pf-CL145A

Source of Chemical (Manufacturer) Marrone Bio Innovations

Storage Location Locked refrigerator in Room 2

Date Received 24APR12 Date Opened 1MAY12 Expiration Date 12JAN13
(5 years unless otherwise stated)

Test Chemical Lot Number TR4669-4-(5) Purity of Chemical 50%

Amount of Test Chemical Available or Received (if known) 5kg

Initial Weight (with cover on) of Test Chemical and Container 5028.3g

Characterization of Test Chemical: Color tan
Physical State: liquid ☐ solid ☒
Solid Form: powder ☒ crystal ☐ pellet ☐

Chemical Abstract Service Number N/A

Manufacturer Certificate of Analysis Yes ☒ No ☐

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Additional Comments About Test Chemical:

Sample Placed in Archives: Yes ☒ No ☐ (Entries should also be made on Form GEN 012.2b)

Archive # PfIII-47 Material Safety Data Sheet Available: Yes ☒ No ☐
FLW 1MAY12

Signature of person (Study Director or designated representative) initiating Test Chemical Use Log and date:

Signature [redacted] Date 24APR12

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ORIGINAL

TEST CHEMICAL USE LOG

Test Chemical: MBI-401 SDP | Manufacturer: Marrone Bio Innovations | Lot #: TR 4669-4-(5)

A Initial weight of chemical & container (with cap/lid on)(g)	B Amount removed (g)	C Weight of chemical & container (g) after removal (with cap/lid on)	D Study # and Purpose	E Comments	F Date/Initials
*1 5025.3	* 6.6818	* 5018.8①	*Archived Sample	AEH-12-PSEUDO-03 and AEH-11-PSEUDO-02	1MAY12 KW
5018.8①	2.00102	5019.2①	AEH-12-PSEUDO-03	AEH-12-PSEUDO-03 BKT Analytical Stock #1	
5019.2①	2.00029	5019.2①		AEH-12-PSEUDO-03 BKT Analytical Stock #2	
5019.2①	720.00	4294.8		AEH-12-PSEUDO-03 BKT Stock #1	
4294.8	720.09	3573.6		AEH-12-PSEUDO-03 BKT Stock #2	
3573.6	720.00	2854.4		AEH-12-PSEUDO-03 BKT Stock #3	
2854.4	720.00	2133.6		AEH-12-PSEUDO-03 BKT Stock #4	
2133.6	719.99	1413.6		AEH-12-PSEUDO-03 BKT Stock #5	
1413.6	720.06	693.1	AEH-12-PSEUDO-03	AEH-12-PSEUDO-03 BKT Stock #6	1MAY12 KW
① Due to the large amount of product in container and the small amount removed for the analytical standards the balance (BAL7) was unable to detect the difference in weight in the container with the product. After consulting with QAU and a chemist it was determined to proceed and acknowledge the weight discrepancies. The analytical aliquots were weighed directly on an analytical balance (BAL5; model CPA225D; S/N 26450930), there is no concern regarding aliquot weight. KW 1MAY12					
692.69	②③5.0009	687.17	AEH-11-PSEUDO-02	AEH-11-PSEUDO-02 PPB Active Stock	15MAY12 KW

② weighed wrong amount of test chemical. Aliquot will not be used to dose PPB. KW 15MAY12

③ This aliquot was shipped back to NYSM for verification. KW 21MAY12

* = The first entry should be the chemical placed in the Chemical Archives. Follow GEN 011.

1 = The initial weight is also entered on Form GEN 012.2a.

A. The weight of the chemical and its container shall be measured by weighing it on a balance that has been verified to be accurate (SOP GEN 013).

B. The chemical removed from the test chemical container will be weighed into a tared vessel.

C. After the chemical has been removed from the test chemical container, r[illegible]eigh the container and its contents (including the cap or

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ORIGINAL

SOP No. GEN 012.2
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Form GEN 012.2b
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TEST CHEMICAL USE LOG

Test Chemical: MBI-401SDP   Manufacturer: Marrone Bio Innovations   Lot #: TR4669-4-(5)

A Initial weight of chemical & container (with cap/lid on)(g)	B Amount removed (g)	C Weight of chemical & container (g) after removal (with cap/lid on)	D Study # and Purpose	E Comments	F Date/Initials
687.17	(1)(4) 5.00091	682.25	AEH-11-PSEUDO-02	Deactive stock for PPB Juvenile mussels	15MAY12 KW
682.41	10.00038	671.95	AEH-11-PSEUDO-02	(2) Deactive Stock for PPB Juvenile Mussels	15MAY12 KW
671.95	10.00012	661.75	AEH-11-PSEUDO-02	(3) Active Stock for PPB Juvenile Mussels	15MAY12 KW
662.23	10.0044	651.74	AEH-11-PSEUDO-02	Active Stock for PPB Juvenile Mussels	16MAY12 KW
652.07	6.04074	645.76	AEH-11-PSEUDO-02 AEH-12-PSEUDO-03	Aliquot to NYSM for verification (3rd Aliquot)	23MAY12 KW
645.92	20.00739	625.50	AEH-11-PSEUDO-02	2 aliquots removed HD Stock 10.00377g, Active stock 10.00365g Small amount spilled.	JMS 5/25/12
625.67	7.75	617.56	AEH-11-PSEUDO-02	Aliquot to NYSM for verification.	4JUN12 KW

(1) Weighed wrong amount of test chemical. Aliquot will not be used to dose PPB. 15MAY12 KW
* = The first entry should be the chemical placed in the Chemical Archives. Follow GEN 011.
! = The initial weight is also entered on Form GEN 012.2a.

(2) This stock was spilled while making. Discarded. KW 16MAY12
(3) This stock was used to make the deactive stock while a new aliquot was weighed to make the active stock. KW 16MAY12

A. The weight of the chemical and its container shall be measured by weighing it on a balance that has been verified to be accurate (SOP GEN 013).
B. The chemical removed from the test chemical container will be weighed into [illegible]ed vessel.
C. After the chemi[illegible] as been removed from the test chemical container, r[illegible] ne container and its contents (including the cap [illegible]

(4) This aliquot was shipped back to NYSM for verification. KW 21MAY12

NYSM Post-Treatment Validation Assay

MBI-401 FDP 110510FD (USGS Study #AEH-11-PSEUDO-02)

Date product received from USGS: 2011/07/20
Date of start of test: 07/20/2011

BACKGROUND: As standard protocol for the USEPA project, each time a batch of Zequanox product is used in a test a UMESC, a portion of the product is bioassayed by the NYSM to validate toxicity post-treatment.

- MBI-401 FDP 110510FD
  - USGS Study #AEH-11-PSEUDO-02: Juveniles (HIC, MUC)

PURPOSE: Post-test product validation of MBI-401 FDP 110510FD from USGS-UMESC.

MATERIALS AND METHODS:

Preparation of product for testing:
Product was shipped under cold conditions and held in the laboratory refrigerator at 4°C until use. Within 30 min of treatment application, prepare each at treatment stock of each MBI-401 formulated product:

MBI 401-110510FD (FDP – 100% active ingredient): Weigh out 1.0 g of the powder into a labeled 50 ml centrifuge tube and bring volume up to 20 ml with dilution water. Vortex until evenly dispersed = 50 mg product/ml or 50 mg ai/ml. For 200 ppm ai treatments in testing jars, add 2 ml to each jar (500 ml).

Cambridge CF (Standard for Positive Controls):
As an efficacy standard, use *Pf*-CL145A killed CF that was maintained at -80°C (Cambridge CF). Since its production in 2005, this material has been valuable as a reference standard. The Cambridge CF was produced in 2005 (2005-0027) in 100-L batches 10, 11 and 12 and E-beamed to kill the cells. The solution, at 110 mg/ml dry weight, is stored in 1 cm thick sheets in the Cambridge ultrafreezer at -80°C. A section of the sheet was broken off and weighed to determine volume (ca. 1 g = 1 ml).

For this bioassay, the positive control suspension was produced on 5-2-2011 by weighing out 33.84 g of frozen Batch 10-12 block (killed cell suspension from test 2005-0027) and diluting with ca. 35 ml dilution water. 7 ml of this suspension were dispersed into 50-ml centrifuge tubes and placed in the ultrafreezer (11 tubes). The dry weight of the material was 43.75 mg/ml; therefore 2.3 ml were added to each testing jar to treat at 200 ppm.

Mussel collections:
Mussels were scraped from substrates (concrete patio blocks and rocks) in the field and placed in plastic bins. Bins containing mussels were set in a cooler with towels and frozen ice packs to maintain temperature to be transported back to the laboratory in Cambridge. In the laboratory, mussels were placed in pint-sized canning jars, covered with mesh, and placed in aquaria containing unchlorinated tap water with circulation (1 Whisper filter) and aeration at ambient laboratory temperature (20°C).

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Item No. 2
Pg 1 of 2

Mussel collection and handling:

Species	Collection site	Collection date	Date in lab (20°C)	Picked for test
Zebra mussels	Hedges Lake (Washington County)	07/19/2011	07/19/2011	07/20/2011 DM

Experimental design:
For validation of efficacy the following treatments will be set up:

Zebra mussels (25 mussels/jar):

3 – Untreated Control
3 – 200 ppm (ai) Cambridge CF (A, B, C)
3 – 200 ppm (ai) MBI 401-110510FD (A, B, C)

Testing jar bioassay protocol:
On the day prior to treatment (07/20/2011) mussels were carefully examined and 25 mussels placed into each testing jar containing ca. 100 ml aerated hard water and allowed to attach overnight. The next morning (07/21/2011), unattached mussels were removed and replaced with attached mussels from an extra glass Petri dish. Water was replaced with 500 ml fresh aerated hard water.

After at least one hour, the treatment was applied. The optical density of each jar was measured in duplicate ($A_{660\,nm}$ Genesys Spectrophotometer).

After 24 hr of treatment, mussel mortality was checked and mussels were transferred to square plastic dishes with fresh aerated hard water. Mortality was checked and recorded each day with water replacements, for an additional 6 days. On the final day of mortality checks, 20 mussels were measured from the untreated controls using a caliper.

Results:

Mussel length: Zebra mussels 8.78 ± 3.02 mm.

Optical density of treatments:

Treatment	Mean (±SD) OD ($A_{660\,nm}$)
Untreated Control	-0.008 ± 0.006
Cambridge CF (Positive Control)	0.159 ± 0.007
MBI-401 FDP 110510FD	0.175 ± 0.014

Zebra mussel mortality: Mussels were treated in triplicate testing jars (500 ml) at 20°C for 24 hr and mortality was recorded for a total of 7 days.

Treatment	Mean % mortality (±SD)
Untreated Control	4.0 ± 4.0%
Cambridge CF (Positive Control)	100.0 ± 0.0%
MBI-401 FDP 110510FD	98.7 ± 2.3% **Pass**

Activity of MBI-401 FDP 110510FD was acceptable for this study.

FF # 86
Item No. 2
Pg 2 of 2

NYSM Post-Treatment Product Validation Assay

MBI-401 FDP 110928FD (USGS Study #AEH-11-PSEUDO-02)

Date product received from USGS: 2011/12/14
Date of start of test: 12/29/2011

BACKGROUND: As standard protocol for the USEPA project, each time a batch of Zequanox product is used in a test a UMESC, a portion of the product is bioassayed by the NYSM to validate toxicity post-treatment.

- MBI-401 FDP 110928FD
    - o USGS Study #AEH-11-PSEUDO-02: Juveniles (WAS)

PURPOSE: Post-test product validation of MBI-401 FDP 110928FD from USGS-UMESC.

MATERIALS AND METHODS:

Preparation of product for testing:
Product was shipped under cold conditions and held in the laboratory refrigerator at 4°C until use. Within 30 min of treatment application, prepare each at treatment stock of each MBI-401 formulated product:

MBI-401 FDP 110928FD (FDP – 100% active ingredient): Weigh out 1.0 g of the powder into a labeled 50 ml centrifuge tube and bring volume up to 20 ml with dilution water. Vortex until evenly dispersed = 50 mg product/ml or 50 mg ai/ml. For 200 ppm ai treatments in testing jars, add 2 ml to each jar (500 ml).

Cambridge CF (Standard for Positive Controls):
As an efficacy standard, use *Pf*-CL145A killed CF that was maintained at -80°C (Cambridge CF). Since its production in 2005, this material has been valuable as a reference standard. The Cambridge CF was produced in 2005 (2005-0027) in 100-L batches 10, 11 and 12 and E-beamed to kill the cells. The solution, at 110 mg/ml dry weight, is stored in 1 cm thick sheets in the Cambridge ultrafreezer at -80°C. A section of the sheet was broken off and weighed to determine volume (ca. 1 g = 1 ml).

For this bioassay, the positive control suspension was produced on 11-14-2011. The dry weight of the material is 65.65 mg/ml; therefore 1.5 ml was added to each testing jar to treat at 200 ppm.

Mussel collections:
Mussels were scraped from substrates (rocks) in the field and placed in plastic bins. Bins containing mussels were set in a cooler with towels and frozen ice packs to maintain temperature to be transported back to the laboratory in Cambridge. In the laboratory, mussels were placed in pint-sized canning jars, covered with mesh, and placed in aquaria containing unchlorinated tap water with circulation (1 Whisper filter) and aeration at ambient laboratory temperature (20°C).

Mussel collection and handling:

Species	Collection site	Collection date	Date in lab (20°C)	Picked for test
Zebra mussels	Hedges Lake (Washington County)	10/18/2011	10/18/2011 Water changes (10/25, 11/4, 11/10, 12/1,12/7,12/14, 12/23)	12/28/2011 MG

FF # 8a
Item No. 3
Pg 1 of 2

Experimental design:
For validation of efficacy the following treatments will be set up:

Zebra mussels (25 mussels/jar):
- 3 – Untreated Control
- 3 – 200 ppm (a.i.) Cambridge CF Positive Control B (A, B, C) (produced on 11-14-2011)
- 3 – 200 ppm (a.i.) MBI-401 110928FD (A, B, C)

Testing jar bioassay protocol:
On the day prior to treatment (12/28/2011) mussels were carefully examined and 25 mussels placed into each testing jar containing ca. 100 ml aerated hard water and allowed to attach overnight. The next morning (12/29/2011), unattached mussels were removed and replaced with attached mussels from an extra glass Petri dish. Water was replaced with 500 ml fresh aerated hard water.

After at least one hour, the treatment was applied. The optical density of each jar was measured in duplicate ($A_{660\ nm}$ Genesys Spectrophotometer).

After 24 hr of treatment, mussel mortality was checked and mussels were transferred to square plastic dishes with fresh aerated hard water. Mortality was checked and recorded each day with water replacements, for an additional 22 days. On the final day of mortality checks, 20 mussels were measured from the untreated controls using a caliper.

Results:

Mussel length: Zebra mussels 12.94 ± 2.28 mm.

Optical density of treatments:

Treatment	Mean (±SD) OD ($A_{660\ nm}$)
Untreated Control	-0.002 ± 0.001
Cambridge CF (Positive Control)	0.187 ± 0.010
MBI-401 FDP 110928FD	0.255 ± 0.001

Zebra mussel mortality: Mussels were treated in triplicate testing jars (500 ml) at 20°C for 24 hr and mortality was recorded for a total of 10 days.

Treatment	Mean % mortality (±SD)
Untreated Control	0.0 ± 0.0%
Cambridge CF (Positive Control)	70.7 ± 8.3%
MBI-401 FDP 110928FD	96.0 ± 6.9% **Pass**

Activity of MBI-401 FDP 110928FD was acceptable for this study.

FF # 86
Item No. 3
Pg 2 of 2

NYSM Post-Treatment Product Validation Assay

MBI-401 SDP 4655-12-Mix (USGS Study #AEH-11-PSEUDO-01)

Date product received from USGS: 2012/02/01 AEH-11-PSEUDO-02
Date of start of test: 02/09/2012

BACKGROUND: As standard protocol for the USEPA project, each time a batch of Zequanox product is used in a test a UMESC, a portion of the product is bioassayed by the NYSM to validate toxicity post-treatment.

- MBI-401 SDP 4655-12-Mix
    - USGS Study #AEH-11-PSEUDO-01: Glochidia (BLS, MUC, HIC)
    - USGS Study #AEH-11-PSEUDO-02: Juvenile (FAM)

PURPOSE: Post-test product validation of MBI-401 SDP 4655-12-Mix from USGS-UMESC.

MATERIALS AND METHODS:

Preparation of product for testing:
Product was shipped under cold conditions and held in the laboratory refrigerator at 4°C until use. Within 30 min of treatment application, prepare each at treatment stock of each MBI-401 formulated product:

MBI-401 SDP 4655-12-Mix (SDP – 50% active ingredient): Weigh out 2 g of the powder and add slowly to a beaker with water stirring for even suspension. Total volume should be 20 ml in dilution water. Transfer to a 50 ml centrifuge and store in refrigerator until ready to use. Mix until evenly dispersed = 100 mg product/ml or 50 mg a.i./ml. For 200 ppm ai treatments in testing jars, add 2 ml to each jar (500 ml).

Cambridge CF (Standard for Positive Controls):
As an efficacy standard, use *Pf*-CL145A killed CF that was maintained at -80°C (Cambridge CF). Since its production in 2005, this material has been valuable as a reference standard. The Cambridge CF was produced in 2005 (2005-0027) in 100-L batches 10, 11 and 12 and E-beamed to kill the cells. The solution, at 110 mg/ml dry weight, is stored in 1 cm thick sheets in the Cambridge ultrafreezer at -80°C. A section of the sheet was broken off and weighed to determine volume (ca. 1 g = 1 ml).

For this bioassay, the positive control suspension was produced on 11-14-2011 and then stored at -80°C in 50-ml centrifuge tubes. The dry weight of the material is 65.65 mg/ml; therefore 1.5 ml was added to each testing jar to treat at 200 ppm.

Mussel collections:
Mussels were scraped from substrates (rocks) in the field and placed in plastic bins. Bins containing mussels were set in a cooler with towels and frozen ice packs to maintain temperature to be transported back to the laboratory in Cambridge. In the laboratory, mussels were placed in pint-sized canning jars, covered with mesh, and placed in aquaria containing unchlorinated tap water with circulation (1 Whisper filter) and aeration at ambient laboratory temperature (20°C).

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Mussel collection and handling:

Species	Collection site	Collection date	Date in lab (20°C)	Picked for test
Zebra mussels	Hedges Lake (Washington County)	11/30/2011	01/31/2012	02/08/2012

Experimental design:

For validation of efficacy the following treatments will be set up: **AEH-11-PSEUDO-02**

Zebra mussels (25 mussels/jar):

3 – Untreated Control

3 – 200 ppm (a.i.) Cambridge CF Positive Control B (A, B, C) (produced on 11-14-2011)

3 – 200 ppm (a.i.) MBI-401 SDP 4655-12-Mix (A, B, C)

Testing jar bioassay protocol:

On the day prior to treatment (02/08/2012) mussels were carefully examined and 25 mussels placed into each testing jar containing ca. 100 ml aerated hard water and allowed to attach overnight. The next morning (02/09/2012), unattached mussels were removed and replaced with attached mussels from an extra glass Petri dish. Water was replaced with 500 ml fresh aerated hard water.

After at least one hour, the treatment was applied. The optical density of each jar was measured in duplicate ($A_{660\,nm}$ Genesys Spectrophotometer).

After 24 hr of treatment, mussel mortality was checked and mussels were transferred to square plastic dishes with fresh aerated hard water. Mortality was checked and recorded each day with water replacements, for an additional 13 days. On the final day of mortality checks, 20 mussels were measured from the untreated controls using a caliper.

Results:

Mussel length: Zebra mussels 12.28 ± 2.89 mm.

Optical density of treatments:

Treatment	Mean (±SD) OD ($A_{660\,nm}$)
Cambridge CF (Positive Control)	0.191 ± 0.008
MBI-401 SDP 4655-12-Mix	0.283 ± 0.007

Zebra mussel mortality: Mussels were treated in triplicate testing jars (500 ml) at 20°C for 24 hr and mortality was recorded for a total of 14 days.

Treatment	Mean % mortality (±SD)
Untreated Control	0.0 ± 0.0%
Cambridge CF (Positive Control)	78.4 ± 6.0%
MBI-401 SDP 4655-12-Mix	85.3 ± 11.5%

MBI-401 SDP 4655-12-Mix PASSED the post-test bioassay validation (85% mortality). Untreated control mortality was 0%.

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NYSM Post-Treatment Product Validation Assay

MBI-401 SDP MBI-401 SDP TR-4669-4-(7-8) 2nd shipment
(USGS Study #AEH-12-PSEUDO-03 and AEH-11-PSEUDO-02)

Date product received from USGS: 2012/04/20 **AEH-11-PSEUDO-02**
Date of start of test: 05/01/2012

BACKGROUND: As standard protocol for the USEPA project, each time a batch of Zequanox product is used in a test a UMESC, a portion of the product is bioassayed by the NYSM to validate toxicity post-treatment.

- MBI-401 SDP TR-4669-4-(7-8) 2nd shipment
    - USGS Study #AEH-12-PSEUDO-03; BLG
    - USGS Study #AEH-11-PSEUDO-02; BLS

PURPOSE: Post-test product validation of MBI-401 SDP TR-4669-4-(7-8) 2nd shipment from USGS-UMESC.

MATERIALS AND METHODS:

Preparation of product for testing:

Product was shipped under cold conditions and held in the laboratory refrigerator at 4°C until use. Within 30 min of treatment application, prepare each at treatment stock of each MBI-401 formulated product:

MBI-401 SDP TR-4669-4-(7-8) 2nd shipment (SDP – 50% active ingredient): 3 g of the powder from each sample was added slowly to a beaker with dilution water stirring for even suspension and then the total volume was adjusted to 30 ml with dilution water. The suspension was transferred to a 50 ml centrifuge and stored in refrigerator until ready to use. The suspension, when evenly dispersed was 100 mg product/ml or 50 mg a.i./ml. For 200 ppm a.i. treatments in testing jars, 2 ml were added to each testing jar (500 ml).

Cambridge CF (Standard for Positive Controls):

As an efficacy standard, we used *Pf*-CL145A killed CF that was maintained at -80°C (Cambridge CF). Since its production in 2005, this material has been valuable as a reference standard. The Cambridge CF was produced in 2005 (2005-0027) in 100-L batches 10, 11 and 12 and E-beamed to kill the cells. The solution, at 110 mg/ml dry weight, is stored in 1 cm thick sheets in the Cambridge ultrafreezer at -80°C. A section of the sheet was broken off and weighed to determine volume (ca. 1 g = 1 ml).

For this bioassay, a positive control suspension was produced on 11-14-2011 from the frozen blocks described above and dispensed into multiple 50-ml centrifuge tubes for single-use treatment of bioassays. The dry weight of the material was 65.65 mg/ml; therefore 1.5 ml was added to each testing jar to treat at 200 ppm.

Mussel collections:

Mussels were scraped from substrates (rocks) in the field and placed in plastic bins. Bins containing mussels were set in a cooler with towels and frozen ice packs to maintain temperature to be transported back to the laboratory in Cambridge. In the laboratory, mussels were placed in pint-sized canning jars, covered with mesh, and placed in aquaria containing unchlorinated tap water with circulation (1 Whisper filter) and aeration at ambient laboratory temperature (ca. 20°C).

Mussel collection and handling:

Species	Collection site	Collection date	Date in lab (20°C)	Picked for test
Zebra mussels	Hedges Lake (Washington County)	10/18/2011	04/23/2012	04/30/2012 **FF #** 8a

wrote in wrong spot [illegible] 7nov2014

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Experimental design: For validation of efficacy the following treatments were set up:

Zebra mussels (25 mussels/jar): AEH-11-PSEUDO-02

3 – Untreated Control
3 – 200 ppm (a.i.) Cambridge CF Positive Control B (A, B, C) (produced on 11-14-2011)
3 – 200 ppm (a.i.) - MBI-401 SDP TR-4669-4-(7-8) 2nd #1
3 – 200 ppm (a.i.) - MBI-401 SDP TR-4669-4-(7-8) 2nd #2
3 – 200 ppm (a.i.) - MBI-401 SDP TR-4669-4-(7-8) 2nd #3

Testing jar bioassay protocol:
On the day prior to treatment (04/30/2012) mussels were carefully examined and 25 mussels placed into each testing jar containing ca. 100 ml aerated hard water and allowed to attach overnight. The next morning (05/01/2012), unattached mussels were removed and replaced with attached mussels from an extra glass Petri dish. Water was replaced with 500 ml fresh aerated hard water.

After at least one hour, the treatment was applied. The optical density of each jar was measured in duplicate ($A_{660\ nm}$ Genesys Spectrophotometer).

After 24 hr of treatment, mussel mortality was checked and mussels were transferred to square plastic dishes with fresh aerated hard water. Mortality was checked and recorded each day with water replacements, for an additional 37 days (38 days total). On the final day of mortality checks, 20 mussels were measured from the untreated controls using a caliper.

Results:

Mussel length: Zebra mussels 12.77 ± 3.61 mm.

Optical density of treatments:

Treatment	Mean (±SD) OD ($A_{660\ nm}$)
Untreated Control	0.002 ± 0.0021
Cambridge CF (Positive Control)	0.177 ± 0.007
MBI-401 SDP TR-4669-4-(7-8) 2nd #1	0.203 ± 0.008
MBI-401 SDP TR-4669-4-(7-8) 2nd #2	0.199 ± 0.003
MBI-401 SDP TR-4669-4-(7-8) 2nd #3	0.195 ± 0.004

Zebra mussel mortality: Mussels were treated in triplicate testing jars (500 ml) at 20°C for 24 hr and mortality was recorded for a total of 38 days (validation tests) and 21 days (KCl tests).

Treatment	Mean % mortality (±SD)	Combined Mean % Mortality (±SD)
Untreated Control	0.0 ± 0.0%	
Cambridge CF (Positive Control) (38 days)	92.0 = 8.0%	
MBI-401 SDP TR-4669-4-(7-8) 2nd #1	72.0 ± 6.9%	**70.7 ± 2.3%**
MBI-401 SDP TR-4669-4-(7-8) 2nd #2	72.0 ± 4.0%	
MBI-401 SDP TR-4669-4-(7-8) 2nd #3	68.0 ± 10.6%	

MBI-401 SDP TR-4669-4-(7-8) 2nd shipment PASSED the post-test bioassay validation (71% mortality). Untreated control mortality was 0%.

FF # 8a
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NYSM Post-Treatment Product Validation Assay

MBI-401 SDP MBI-401 SDP TR-4669-4-(5)
(USGS Study #AEH-12-PSEUDO-03 and AEH-11-PSEUDO-02)

Date product received from USGS: 2012/05/24
Date of start of test: 05/29/2012

AEH-11-PSEUDO-02

BACKGROUND: As standard protocol for the USEPA project, each time a batch of Zequanox product is used in a test a UMESC, a portion of the product is bioassayed by the NYSM to validate toxicity post-treatment.

- MBI-401 SDP TR-4669-4-(5)
  - USGS Study #AEH-12-PSEUDO-03; BKT
  - USGS Study #AEH-11-PSEUDO-02; PPB

PURPOSE: Post-test product validation of MBI-401 SDP TR-4669-4-(5) from USGS-UMESC.

MATERIALS AND METHODS:

Preparation of product for testing:

Product was shipped under cold conditions and held in the laboratory refrigerator at 4°C until use. Within 30 min of treatment application, prepare each at treatment stock of each MBI-401 formulated product:

MBI-401 SDP TR-4669-4-(5) (SDP – 50% active ingredient): 3 g of the powder from each sample was added slowly to a beaker with dilution water stirring for even suspension and then the total volume was adjusted to 30 ml with dilution water. The suspension was transferred to a 50 ml centrifuge and stored in refrigerator until ready to use. The suspension, when evenly dispersed was 100 mg product/ml or 50 mg a.i./ml. For 200 ppm a.i. treatments in testing jars, 2 ml were added to each testing jar (500 ml).

Cambridge CF (Standard for Positive Controls):

As an efficacy standard, we used *Pf*-CL145A killed CF that was maintained at -80°C (Cambridge CF). Since its production in 2005, this material has been valuable as a reference standard. The Cambridge CF was produced in 2005 (2005-0027) in 100-L batches 10, 11 and 12 and E-beamed to kill the cells. The solution, at 110 mg/ml dry weight, is stored in 1 cm thick sheets in the Cambridge ultrafreezer at -80°C. A section of the sheet was broken off and weighed to determine volume (ca. 1 g = 1 ml).

For this bioassay, a positive control suspension was produced on 11-14-2011 from the frozen blocks described above and dispensed into multiple 50-ml centrifuge tubes for single-use treatment of bioassays. The dry weight of the material was 65.65 mg/ml; therefore 1.5 ml was added to each testing jar to treat at 200 ppm.

Mussel collections:

Mussels were scraped from substrates (rocks) in the field and placed in plastic bins. Bins containing mussels were set in a cooler with towels and frozen ice packs to maintain temperature to be transported back to the laboratory in Cambridge. In the laboratory, mussels were placed in pint-sized canning jars, covered with mesh, and placed in aquaria containing unchlorinated tap water with circulation (1 Whisper filter) and aeration at ambient laboratory temperature (ca. 20°C).

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Mussel collection and handling:

Species	Collection site	Collection date	Date in lab (20°C)	Picked for test
Zebra mussels	Hedges Lake (Washington County)	10/18/2011 and 12/28/2011	04/23/2012, 05/17/2012, and 05/23/2012 (mixed randomly)	05/28/2012

Experimental design: For validation of efficacy the following treatments were set up:

Zebra mussels (25 mussels/jar):

3 – Untreated Control

3 – 200 ppm (a.i.) Cambridge CF Positive Control (produced on 11-14-2011)

3 – 200 ppm (a.i.) - MBI-401 SDP TR-4669-4-(5)

Testing jar bioassay protocol:

On the day prior to treatment (05/28/2012) mussels were carefully examined and 25 mussels placed into each testing jar containing ca. 100 ml aerated hard water and allowed to attach overnight. The next morning (05/29/2012), unattached mussels were removed and replaced with attached mussels from an extra glass Petri dish. Water was replaced with 500 ml fresh aerated hard water.

After at least one hour, the treatment was applied. The optical density of each jar was measured in duplicate ($A_{660\ nm}$ Genesys Spectrophotometer).

After 24 hr of treatment, mussel mortality was checked and mussels were transferred to square plastic dishes with fresh aerated hard water. Mortality was checked and recorded each day with water replacements, for an additional 20 days (21 days total). On the final day of mortality checks, 20 mussels were measured from the untreated controls using a caliper.

Results:

Mussel length: Zebra mussels 13.23 ± 3.30 mm.

Optical density of treatments:

Treatment	Mean (±SD) OD ($A_{660\ nm}$)
Untreated Control	0.008 ± 0.005
Cambridge CF (Positive Control)	0.203 ± 0.006
MBI-401 SDP TR-4669-4-(5) (Post-test validation)	0.264 ± 0.007

Zebra mussel mortality: Mussels were treated in triplicate testing jars (500 ml) at 20°C for 24 hr and mortality was recorded for a total of 21 days.

Treatment	Mean % mortality (±SD)
Untreated Control	0.0 ± 0.0%
Cambridge CF (Positive Control)	85.3 ± 12.2%
MBI-401 SDP TR-4669-4-(5) (Post-test validation)	76.0 ± 8.0%

MBI-401 SDP TR-4669-4-(5) shipment PASSED the post-test bioassay validation (76% mortality). Untreated control mortality was 0%.

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NYSM Post-Treatment Product Validation Assay

MBI-401 SDP MBI-401 SDP TR-4669-4-(5)
(USGS Study # AEH-11-PSEUDO-02)

Date product received from USGS: 2012/06/05
Date of start of test: 06/06/2012

AEH-11-PSEUDO-02

BACKGROUND: As standard protocol for the USEPA project, each time a batch of Zequanox product is used in a test a UMESC, a portion of the product is bioassayed by the NYSM to validate toxicity post-treatment.

- MBI-401 SDP TR-4669-4-(5)
  - USGS Study #AEH-11-PSEUDO-02; HGE

PURPOSE: Post-test product validation of MBI-401 SDP TR-4669-4-(5) from USGS-UMESC.

MATERIALS AND METHODS:

Preparation of product for testing:

Product was shipped under cold conditions and held in the laboratory refrigerator at 4°C until use. Within 30 min of treatment application, prepare each at treatment stock of each MBI-401 formulated product:

MBI-401 SDP TR-4669-4-(5) (SDP – 50% active ingredient): 3 g of the powder from each sample was added slowly to a beaker with dilution water stirring for even suspension and then the total volume was adjusted to 30 ml with dilution water. The suspension was transferred to a 50 ml centrifuge and stored in refrigerator until ready to use. The suspension, when evenly dispersed was 100 mg product/ml or 50 mg a.i./ml. For 200 ppm a.i. treatments in testing jars, 2 ml were added to each testing jar (500 ml).

Cambridge CF (Standard for Positive Controls):

As an efficacy standard, we used *Pf*-CL145A killed CF that was maintained at -80°C (Cambridge CF). Since its production in 2005, this material has been valuable as a reference standard. The Cambridge CF was produced in 2005 (2005-0027) in 100-L batches 10, 11 and 12 and E-beamed to kill the cells. The solution, at 110 mg/ml dry weight, is stored in 1 cm thick sheets in the Cambridge ultrafreezer at -80°C. A section of the sheet was broken off and weighed to determine volume (ca. 1 g = 1 ml).

For this bioassay, a positive control suspension was produced on 11-14-2011 from the frozen blocks described above and dispensed into multiple 50-ml centrifuge tubes for single-use treatment of bioassays. The dry weight of the material was 65.65 mg/ml; therefore 1.5 ml was added to each testing jar to treat at 200 ppm.

Mussel collections:

Mussels were scraped from substrates (rocks) in the field and placed in plastic bins. Bins containing mussels were set in a cooler with towels and frozen ice packs to maintain temperature to be transported back to the laboratory in Cambridge. In the laboratory, mussels were placed in pint-sized canning jars, covered with mesh, and placed in aquaria containing unchlorinated tap water with circulation (1 Whisper filter) and aeration at ambient laboratory temperature (ca. 20°C).

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Mussel collection and handling:

Species	Collection site	Collection date	Date in lab (20°C)	Picked for test
Zebra mussels	Hedges Lake (Washington County)	10/18/2011	05/31/2012	06/05/2012

Experimental design: For validation of efficacy the following treatments were set up:

Zebra mussels (25 mussels/jar):

3 – Untreated Control

3 – 200 ppm (a.i.) Cambridge CF Positive Control (produced on 11-14-2011)

3 – 200 ppm (a.i.) - MBI-401 SDP TR-4669-4-(5)

Testing jar bioassay protocol:

On the day prior to treatment (06/05/2012) mussels were carefully examined and 25 mussels placed into each testing jar containing ca. 100 ml aerated hard water and allowed to attach overnight. The next morning (06/06/2012), unattached mussels were removed and replaced with attached mussels from an extra glass Petri dish. Water was replaced with 500 ml fresh aerated hard water.

After at least one hour, the treatment was applied. The optical density of each jar was measured in duplicate ($A_{660\ nm}$ Genesys Spectrophotometer).

After 24 hr of treatment, mussel mortality was checked and mussels were transferred to square plastic dishes with fresh aerated hard water. Mortality was checked and recorded each day with water replacements, for an additional 20 days (21 days total). On the final day of mortality checks, 20 mussels were measured from the untreated controls using a caliper.

Results:

Mussel length: Zebra mussels 13.62 ± 2.77 mm.

Optical density of treatments:

Treatment	Mean (±SD) OD ($A_{660\ nm}$)
Untreated Control	0.009 ± 0.001
Cambridge CF (Positive Control)	0.187 ± 0.005
MBI-401 SDP TR-4669-4-(5) Post-test validation	0.262 ± 0.007
MBI-401 SDP TR-4669-3-(6) check for veligers tests	0.256 ± 0.005

Zebra mussel mortality: Mussels were treated in triplicate testing jars (500 ml) at 20°C for 24 hr and mortality was recorded for a total of 21 days.

Treatment	Mean % mortality (±SD)
Untreated Control	1.3 ± 2.3%
Cambridge CF (Positive Control)	84.0 ± 12.0%
MBI-401 SDP TR-4669-4-(5) Post-test validation	76.0 ± 6.9%

MBI-401 SDP TR-4669-4-(5) shipment PASSED the post-test bioassay validation (76% mortality). Untreated control mortality was 1%.

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Appendix 5. Test Animal Information

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid mussel species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 27 MAY 2011

Test Organism Species List, Collection and Inclusion Criteria

Common name	Scientific name
Black sandshell	*Ligumia recta*
Fatmucket	*Lampsilis siliquoidea*
Hickorynut	*Obovaria olivaria*
Higgins eye	*Lampsilis higginsii*
Mucket	*Actinonaias ligamentina*
Plain pocketbook	*Lampsilis cardium*
Washboard	*Megalonaias nervosa*

Collection and inclusion criteria (see protocol sections 4.1- 4.2):

Donor mussel collection, host fish inoculation, and newly metamorphosed mussels harvesting will be performed at the Genoa NFH by USFWS biologists. Gravid donor mussels will be collected from the Upper Iowa, Upper Mississippi or St. Croix Rivers. Mussels will be identified to species as described in Cummings and Mayer (1992) and Watters et al. (2009) by staff at the Genoa NFH. Approximately 1,200 juvenile mussels from each species will be collected from the mussel propagation aquaria by Genoa NFH biologists and transferred to the UMESC at ~20°C. After acclimation to UMESC test water, the mussels will be placed in petri dishes and viewed under a dissecting microscope. Twenty mussels displaying active foot movement will be transferred with a disposable pipet into a 50-mL beaker or petri dish containing 20°C well water. The beaker or petri dish will then be emptied and rinsed into a randomly chosen exposure chamber containing 20°C well water and approximately 4 mm of 75 – 150 µm silica sand as substrate. The process will then be repeated until all exposure chambers receive a total of two distribution aliquots for a total of 40 juveniles for each exposure chamber. Additionally, two randomly chosen groups of 20 mussels of each species will be preserved to determine the initial mussel valve length.

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Item No. 1
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Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 7A Lab book/pgs 2/6-7 Proofed: KLW Reviewed: JAL 11/21/14
TS 12 JAN 12 25 JUL 11

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species: Obovaria olivaria (Hickory nut; HIC) KLW 25 JUL 11

Collection Date(s) : 11 JUL 2011

Collection Location: Genoa NFH **Container ID:** ~~Mucket 1~~ Incorrect container ID. Correct container ID is HIC 1 KLW 13 JUL 2011

Approximate Number of Mussels: 600

Mussel collected and identified by: Nathan Eckert **Genoa NFH**

Additional information:

Started acclimation by adding KLW 11 JUL 11 ½ UMESC acclimation well water at 20°C at Genoa NFH at 1100.

1200 - 50% water change with UMESC 20°C well water at UMESC

UMESC MUSSEL LOT NUMBER DESIGNATION: ~~112800~~ Not legible Should be 112800 KLW 25 JUL 11

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	11 JUL 11
Printed Name	Signature	Affiliation	Date

FF # 7a
Item No. 4
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Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 7A Lab book/pgs: 2/12 Proofed: KLW 25 JUL 11 Reviewed: JN 11/21/14

Newly Metamorphosed Juvenile Mussel Test Organism
UMESC Lot Number Assignment Form

Species: Mucket Actinonaias ligamentina (MUC) KLW 25 JUL 11

Collection Date(s) : 7/13/11

Collection Location: Genoa NFH **Container ID:** MUC 1

Approximate Number of Mussels: 2,000

Mussel collected and identified by: Jorge Buening **Genoa NFH**

Additional information:

1/2 H_2O exchange at Genoa NFH ~ 0900 h

1/2 H_2O exchange at UMESC ~ 1000 h

UMESC MUSSEL LOT NUMBER DESIGNATION: 112900

Witness and form recorded by:

James A. Luoma	[redacted]	UMESC	7/13/11
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 7a
Item No. 5
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 7A Lab book/pgs: 2/26 Proofed: TJS 12JAN12 Reviewed: JL 1/21/14

Newly Metamorphosed Juvenile Mussel Test Organism
UMESC Lot Number Assignment Form

Species: Washboard (M. nervosa) Megalonaias nervosa (WAS) KLW 12JAN12

Collection Date(s) : 12 DEC 2011

Collection Location: Genoa NFH **Container ID:** Container 1

Approximate Number of Mussels: 2,000

Mussel collected and identified by: Nathan Eckert **Genoa NFH**

Additional information:

≤ 48 hour old animals

½ H_2O exchange at Genoa NFH ~ 1030h

½ H_2O exchange at UMESC ~ 1145h

UMESC MUSSEL LOT NUMBER DESIGNATION: 116100

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	12 DEC 2011
Printed Name	**Signature**	**Affiliation**	**Date**

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Study Title: **"Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"**

Study number: AEH-11-PSEUDO-02

File Folder: 7A Lab book/pgs: 2/33 Reviewed: 23APR12 TJS Verified: Jo 11-21-14

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species: Fatmucket (Lampsilis siliquoidea)

Collection Date(s) : 26JAN2012

Collection Location: Genoa NFH **Container ID:** Bucket #1

Approximate Number of Mussels: 3100

Mussel collected and identified by: Nathan Eckert **Affiliation** Genoa NFH (USFWS)

Dosing Date: 27JAN2012 **Formulation and lot #** SDP 4655-12-mix

Additional information:

0940: 50% 20°C UMESC well water exchange at Genoa NFH.

1035: 50% 20°C UMESC well water exchange at UMESC.

UMESC MUSSEL LOT NUMBER DESIGNATION: 121000

Witness and form recorded by:

Todd J. Severson	[redacted]	UMESC	26 JAN 12
Printed Name	**Signature**	**Affiliation**	**Date**

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This datasheet was approved by [redacted] on 18JAN2012
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 7a Lab book/pgs: 2/40 Reviewed: 23Apr12 TVS Verified: 11-21-14

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species: BLS

Collection Date(s) : 4/16/12

Collection Location: Genoa NFH **Container ID:** Bucket #1

Approximate Number of Mussels: 2500

Mussel collected and identified by: Nathan Eckert **Affiliation** USFWS

Dosing Date: 4/17/12 **Formulation and lot #** TR 4669-4-(7-8) 2nd -SOP

Additional information:

UMESC MUSSEL LOT NUMBER DESIGNATION: 12/400

Witness and form recorded by:

Printed Name	Signature	Affiliation	Date
James A. Luoma	[redacted]	UMESC	4/16/12

FF # 7a
Item No. 3
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This datasheet was approved by [redacted] on 18Jan12
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 7A Lab book/pgs: 2/45-46 Reviewed: RW 7 Nov 2014 Verified: Jn 11-21-14

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species: Plain Pocketbook

Collection Date(s) : 15 MAY 12

Collection Location: Genoa NFH **Container ID:** Container 1

Approximate Number of Mussels: 2,000

Mussel collected and identified by: Nathan Eckert **Affiliation** Genoa NFH (USFWS)

Dosing Date: 16 MAY 12 **Formulation and lot #** MBI-401 SDP TR-4669-4-(5)

Additional information:

1100: 50% 20°C UMES well water exchange at Genoa NFH

1215: 50% 20°C UMESC well water exchange at UMESC

UMESC MUSSEL LOT NUMBER DESIGNATION: 121700

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	15MAY12
Printed Name	Signature	Affiliation	Date

FF # 7a
Item No. 9
Pg 1 of 1

This datasheet was approved by [redacted] on 18JAN2012
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 7A Lab book/pgs: 2/50, 3/1 Reviewed: 4 Nov 2014 Verified: 11-21-14

Newly Metamorphosed Juvenile Mussel Test Organism UMESC Lot Number Assignment Form

Species: HGE (Higgins Eye)

Collection Date(s) : 5/25/12

Collection Location: Genoa NFH **Container ID:** 1

Approximate Number of Mussels: 3,000

Mussel collected and identified by: Nathan Eckert **Affiliation** Genoa NFH

Dosing Date: 5/26/12 **Formulation and lot #** SDP TR-4669-4-(5)

Additional information:

1/2 H_2O exchange @ Genoa NFH at ~ 1230

1/2 H_2O exchange @ UMESC at ~ 1330

UMESC MUSSEL LOT NUMBER DESIGNATION: 121900

Witness and form recorded by:

James A. Luoma	[redacted]	UMESC	5/25/12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 7a
Item No. 10
Pg 1 of 1

This datasheet was approved by [redacted] on 13 Jan 2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 14 [redacted] Lab book/pgs: 2/7 Proofed: TJS 19JAN12 Reviewed: JN 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: Obovaria olivaria **UMESC LOT NUMBER:** 112800

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 1020 (40/chamber x 24 chambers +60 preserved)

Initial Distribution Aliquot date/time (military): 1220 11JUL11

Final Distribution Aliquot date/time (military): 1420 11JUL11

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	11JUL11
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 14
Item No. 4
Pg 1 of 1

Study Title: **"Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"**

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 14 Lab book/pgs: 2/13 Proofed: TJS 19JAN12 Reviewed: JAL 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: Actinonaias ligamentina **UMESC LOT NUMBER:** 112900

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 1020 (40/chamber x 24 chambers + 60 preserved)

Initial Distribution Aliquot date/time (military): 1215 13JUL11

Final Distribution Aliquot date/time (military): 1429 13JUL11

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	13JUL2011
Printed Name	**Signature**	**Affiliation**	**Date**

signature not printed name. KLW 7/13/2011

FF # 14
Item No. 5
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

Approved by [redacted] Date 31 MAY 2011

File Folder: 14 [redacted] Lab book/pgs: 2/26 Proofed: KLW 19JAN12 Reviewed: JA 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: Washboard (M. nervosa) **UMESC LOT NUMBER:** 116100

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 20

Initial Distribution Aliquot date/time (military): 1250 12DEC11 KW

Final Distribution Aliquot date/time (military): 1355 12 DEC11 KW

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

Witness and form recorded by:

James A. Luoma	[redacted]	UMESC	12/12/11
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 14
Item No. 6
Pg 1 of 1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 14 Lab book/pgs: 2/32-33 Reviewed: 23APR12 TJS Verified: JAL 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: Fatmucket **UMESC LOT NUMBER:** 121 000

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 20

Initial Distribution Aliquot date/time (military): 1152 / 26JAN12

Final Distribution Aliquot date/time (military): 1339 / 26JAN12

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	26JAN12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 14
Item No. 7
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 14 Lab book/pgs: 2/40 Reviewed: TJS 23APR12 Verified: JNL 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: Black sandshell **UMESC LOT NUMBER:** 121400

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 480

Initial Distribution Aliquot date/time (military): 1320 16 APR12 JW

Final Distribution Aliquot date/time (military): 1409 16 APR12 JW

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

Witness and form recorded by:

James A. Luoma	[redacted]	UMESC	4/16/12
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 14
Item No. 8
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 14 Lab book/pgs: 2/45-46 Reviewed: JWW 21NOV14 Verified: JAL 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: Plain Pocketbook **UMESC LOT NUMBER:** 121702

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 20/chamber/Distribution round (24 chambers; 2 rounds)

Initial Distribution Aliquot date/time (military): 1230 15 MAY 12

Final Distribution Aliquot date/time (military): 1415 15 MAY 12

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

Witness and form recorded by:

Kerry L. Weber	[redacted]	UMESC	15MAY2012
Printed Name	**Signature**	**Affiliation**	**Date**

FF # 14
Item No. 9
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Study Title: "Effects of *Pseudomonas fluorescens* (*Pf*-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species"

Study number: AEH-11-PSEUDO-02

File Folder: 14 Lab book/pgs: 2/50, 3/1 Reviewed: JW 2NOV14 Verified: JAL 11-21-14

Newly Metamorphosed Juvenile Mussel Distribution Form

Species: HGE **UMESC LOT NUMBER:** 121900

Test Block Assignment (circle one): 1 2 3

Estimated # Mussels/Distribution 20 distribution to each chamber per round ①

Initial Distribution Aliquot date/time (military): 5/25/12 1400

Final Distribution Aliquot date/time (military): 5/25/12 1630

Number of Aliquot rounds: 2 **Number of mussels/chamber** 40

Additional information:

① Two distribution rounds of 20 mussels to each of 24 chambers 5-25-12 JAL

Witness and form recorded by:

Printed Name	Signature	Affiliation	Date
JAMES A. LUOMA	[redacted]	UMESC	5/25/12

FF # 14
Item No. 10
Pg 1 of 1

This datasheet was approved by [redacted] on 11 JAN 2012.
11JAN2012/version1.1

Appendix 6. Water Quality and System Conditions

Study Number: AEH-11-PSEUDO-02	Action	Date	Initials
Data Source: File Folders: 10a-10c, 10e	Created......	1-May-14	KLW
Water Quality Forms: 1, 1a, 1b, 2, 3, 3b	Revised......	19-Nov-14	KLW
	Reviewed...	19Nov14	
	Certified...	11/21/14	JA
File Name: I:\AEH-11-PSEUDO-02\Data\[PSEUDO-02 Water Chem for SAS.xlsx]Exposure Water Chem			

Exposure Period Water Chemistry

Species, Dosing, and Assessment Information

Scientific Name	Common Name	Abbreviation	Formulation Type	Test Article Lot Number	Exposure Date	Assessment Date
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	12-Jul-11	20-Jul-11
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	14-Jul-11	22-Jul-11
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	13-Dec-11	21-Dec-11
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	27-Jan-12	4-Feb-12
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	17-Apr-12	25-Apr-12
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	16-May-12	24-May-12
Lampsilis higginsii	Higgins eye	HGE	SDP	TR4669-4-(5)	26-May-12	3-Jun-12

Data codes used within SAS

sps = Juvenile mussel species (see 3 letter abbreviation codes above)
time = Sample time
- 0 = Pre-exposure
- 1 = First sampling time during exposure
- 2 = Second sampling time during exposure
- 3 = Exposure termination

form = Product formulation
- FDP = Freeze dried powder
- SDP = Spray dried powder

conc = Concentration (mg/L)
- 0 = Control (no product added)
- 50 = 50 mg/L active ingredient
- 100 = 100 mg/L active ingredient
- 200 = 200 mg/L active ingredient
- 300 = 300 mg/L active ingredient
- 400 = 300 mg/L deactive ingredient

id = Exposure chamber ID
- i.e., 1A2 = Test system (1, 2, or 3), Block ID (A or B), and Position in Block (1-12)

do = Dissolved oxygen (in mg/L)
temp = Temperature (in °C)
pH = pH
hard = Water hardness (in mg/L of $CaCO_3$)
alk = Alkalinity (in mg/L of CaCO3)
cond = Conductivity (in µS/cm temperature compensated to 25°C)

Data Explanation

Water chemistry data analyses were limited to simple descriptive statistics (Proc Means) using SAS Version 9.4.

Data Anomalies and Deviations

NONE

File Folder 10
Item Number 1
Page 1 of 9

sps	time	form	conc	id	do	temp	ph	hard	alk	cond
HIC	0	FDP	.	.	8.33	21.0	8.21	172	118	374
MUC	0	FDP	.	.	8.77	20.6	8.24	179	130	371
WAS	0	FDP	.	.	8.70	20.1	8.20	178	125	387
FAM	0	SDP	.	.	8.50	20.8	7.68	180	126	396
BLS	0	SDP	.	.	8.77	19.9	8.32	180	125	376
PPB	0	SDP	.	.	8.33	20.7	8.10	172	128	372
HGE	0	SDP	.	.	8.79	20.5	8.22	174	128	370
HIC	1	FDP	0	1A2	8.50	20.1	8.23	.	.	.
HIC	1	FDP	0	1A5	8.54	20.1	8.24	.	.	.
HIC	1	FDP	0	1B2	8.53	20.0	8.22	.	.	.
HIC	1	FDP	0	1B12	8.47	20.2	8.20	.	.	.
HIC	1	FDP	400	1A8	8.49	20.1	8.05	.	.	.
HIC	1	FDP	400	1A10	8.48	20.2	8.06	.	.	.
HIC	1	FDP	400	1B6	8.46	20.1	8.01	.	.	.
HIC	1	FDP	400	1B7	8.46	20.1	7.99	.	.	.
HIC	1	FDP	50	1A4	8.45	19.9	8.20	.	.	.
HIC	1	FDP	50	1A7	8.43	20.1	8.19	.	.	.
HIC	1	FDP	50	1B9	8.49	20.1	8.19	.	.	.
HIC	1	FDP	50	1B11	8.55	20.1	8.21	.	.	.
HIC	1	FDP	100	1A6	8.54	20.0	8.20	.	.	.
HIC	1	FDP	100	1A9	8.46	20.2	8.17	.	.	.
HIC	1	FDP	100	1B3	8.48	19.9	8.15	.	.	.
HIC	1	FDP	100	1B10	8.46	20.1	8.17	.	.	.
HIC	1	FDP	200	1A1	8.55	19.9	8.20	.	.	.
HIC	1	FDP	200	1A11	8.52	20.1	8.17	.	.	.
HIC	1	FDP	200	1B5	8.45	20.0	8.14	.	.	.
HIC	1	FDP	200	1B8	8.42	20.1	8.09	.	.	.
HIC	1	FDP	300	1A3	8.50	19.8	8.11	.	.	.
HIC	1	FDP	300	1A12	8.36	20.1	8.06	.	.	.
HIC	1	FDP	300	1B1	8.56	19.8	8.10	.	.	.
HIC	1	FDP	300	1B4	8.54	19.9	8.09	.	.	.
HIC	2	FDP	0	1A2	8.75	18.3	8.30	.	.	.
HIC	2	FDP	0	1A5	8.98	18.2	8.33	.	.	.
HIC	2	FDP	400	1A8	6.21	18.6	8.00	.	.	.
HIC	2	FDP	400	1A10	6.03	18.5	8.00	.	.	.
HIC	2	FDP	50	1A4	8.24	18.2	8.26	.	.	.
HIC	2	FDP	50	1A7	8.09	18.5	8.22	.	.	.
HIC	2	FDP	100	1A6	8.35	18.3	8.17	.	.	.
HIC	2	FDP	100	1A9	7.76	18.5	8.17	.	.	.
HIC	2	FDP	200	1A1	8.20	18.3	8.21	.	.	.
HIC	2	FDP	200	1A11	8.09	18.5	8.17	.	.	.
HIC	2	FDP	300	1A12	6.28	18.7	8.03	.	.	.
HIC	2	FDP	300	1A3	6.42	18.2	8.04	.	.	.
HIC	2	FDP	0	1B2	8.39	18.2	8.35	.	.	.
HIC	2	FDP	0	1B12	8.64	18.7	8.33	.	.	.
HIC	2	FDP	400	1B6	7.83	18.3	8.02	.	.	.
HIC	2	FDP	400	1B7	7.65	18.3	7.97	.	.	.
HIC	2	FDP	50	1B9	7.69	18.5	8.24	.	.	.
HIC	2	FDP	50	1B11	8.08	18.6	8.27	.	.	.
HIC	2	FDP	100	1B3	6.41	18.3	8.06	.	.	.
HIC	2	FDP	100	1B10	6.45	18.5	8.16	.	.	.

HIC	2	FDP	200	1B5	6.39	18.3	8.08	.	.	.
HIC	2	FDP	200	1B8	7.32	18.4	8.14	.	.	.
HIC	2	FDP	300	1B1	6.46	18.2	7.99	.	.	.
HIC	2	FDP	300	1B4	5.86	18.3	7.95	.	.	.
MUC	1	FDP	0	2A4	8.31	20.1	8.15	.	.	.
MUC	1	FDP	0	2A11	8.42	19.7	8.14	.	.	.
MUC	1	FDP	0	2B7	8.41	19.8	8.18	.	.	.
MUC	1	FDP	0	2B10	8.45	19.7	8.18	.	.	.
MUC	1	FDP	400	2A8	8.35	19.7	7.96	.	.	.
MUC	1	FDP	400	2A12	8.46	19.4	7.96	.	.	.
MUC	1	FDP	400	2B1	8.41	19.6	7.93	.	.	.
MUC	1	FDP	400	2B6	8.42	19.8	7.95	.	.	.
MUC	1	FDP	50	2A3	8.38	20.1	8.15	.	.	.
MUC	1	FDP	50	2B5	8.37	19.8	8.14	.	.	.
MUC	1	FDP	50	2B9	8.41	19.6	8.14	.	.	.
MUC	1	FDP	50	2A10	8.37	19.7	8.14	.	.	.
MUC	1	FDP	100	2B8	8.34	19.7	8.14	.	.	.
MUC	1	FDP	100	2B3	8.46	19.8	8.15	.	.	.
MUC	1	FDP	100	2A6	8.33	19.8	8.09	.	.	.
MUC	1	FDP	100	2A7	8.44	19.7	8.15	.	.	.
MUC	1	FDP	200	2A1	8.42	19.7	8.07	.	.	.
MUC	1	FDP	200	2A5	8.44	19.7	8.13	.	.	.
MUC	1	FDP	200	2B11	8.46	19.6	8.09	.	.	.
MUC	1	FDP	200	2B12	8.42	19.6	8.04	.	.	.
MUC	1	FDP	300	2B2	8.43	19.7	8.04	.	.	.
MUC	1	FDP	300	2B4	8.40	19.7	8.02	.	.	.
MUC	1	FDP	300	2A2	8.40	19.8	8.08	.	.	.
MUC	1	FDP	300	2A9	8.42	19.6	8.04	.	.	.
MUC	2	FDP	200	2A1	8.49	18.9	8.23	.	.	.
MUC	2	FDP	300	2A2	8.12	18.8	8.12	.	.	.
MUC	2	FDP	50	2A3	8.65	18.8	8.26	.	.	.
MUC	2	FDP	0	2A4	8.78	18.8	8.12	.	.	.
MUC	2	FDP	200	2A5	8.27	18.7	8.13	.	.	.
MUC	2	FDP	100	2A6	8.57	18.7	8.21	.	.	.
MUC	2	FDP	100	2A7	8.73	18.6	8.26	.	.	.
MUC	2	FDP	400	2A8	7.67	18.4	8.00	.	.	.
MUC	2	FDP	300	2A9	8.02	18.5	8.07	.	.	.
MUC	2	FDP	50	2A10	8.55	18.3	8.18	.	.	.
MUC	2	FDP	0	2A11	8.92	18.3	8.30	.	.	.
MUC	2	FDP	400	2A12	7.45	18.3	7.96	.	.	.
MUC	2	FDP	400	2B1	7.64	18.5	7.98	.	.	.
MUC	2	FDP	300	2B2	8.18	18.4	8.10	.	.	.
MUC	2	FDP	100	2B3	8.79	18.4	8.30	.	.	.
MUC	2	FDP	300	2B4	7.29	18.5	7.98	.	.	.
MUC	2	FDP	50	2B5	8.59	18.5	8.22	.	.	.
MUC	2	FDP	400	2B6	7.74	18.3	8.01	.	.	.
MUC	2	FDP	0	2B7	8.97	18.3	8.32	.	.	.
MUC	2	FDP	100	2B8	8.71	18.3	8.27	.	.	.
MUC	2	FDP	50	2B9	8.76	18.2	8.25	.	.	.
MUC	2	FDP	0	2B10	8.97	18.2	8.35	.	.	.
MUC	2	FDP	200	2B11	8.31	18.4	8.13	.	.	.
MUC	2	FDP	200	2B12	8.23	18.6	8.13	.	.	.

WAS	1	FDP	0	2A9	8.10	19.7	8.14	.	.	.
WAS	1	FDP	0	2A11	8.12	19.8	8.05	.	.	.
WAS	1	FDP	0	2B1	8.47	19.8	8.05	.	.	.
WAS	1	FDP	0	2B7	8.65	19.6	8.07	.	.	.
WAS	1	FDP	400	2A5	8.44	19.8	7.89	.	.	.
WAS	1	FDP	400	2A7	8.52	19.8	7.82	.	.	.
WAS	1	FDP	400	2B5	8.55	19.7	7.96	.	.	.
WAS	1	FDP	400	2B8	8.53	19.5	7.89	.	.	.
WAS	1	FDP	50	2A1	8.24	19.6	7.98	.	.	.
WAS	1	FDP	50	2A12	8.30	19.6	7.96	.	.	.
WAS	1	FDP	50	2B2	8.52	19.6	8.05	.	.	.
WAS	1	FDP	50	2B11	8.62	19.4	8.11	.	.	.
WAS	1	FDP	100	2A2	8.32	20.0	8.04	.	.	.
WAS	1	FDP	100	2A3	8.10	20.0	7.99	.	.	.
WAS	1	FDP	100	2B9	8.43	19.7	8.02	.	.	.
WAS	1	FDP	100	2B12	8.54	19.9	8.11	.	.	.
WAS	1	FDP	200	2A6	8.37	19.9	7.99	.	.	.
WAS	1	FDP	200	2A10	8.11	19.8	7.97	.	.	.
WAS	1	FDP	200	2B3	8.45	19.8	8.01	.	.	.
WAS	1	FDP	200	2B10	8.55	19.6	8.05	.	.	.
WAS	1	FDP	300	2A4	8.39	19.7	7.95	.	.	.
WAS	1	FDP	300	2A8	8.38	19.7	7.97	.	.	.
WAS	1	FDP	300	2B4	8.47	19.6	7.99	.	.	.
WAS	1	FDP	300	2B6	8.35	19.6	7.97	.	.	.
WAS	2	FDP	0	2A9	8.69	19.2	8.27	.	.	.
WAS	2	FDP	0	2A11	8.63	19.2	8.24	.	.	.
WAS	2	FDP	0	2B1	8.59	19.9	8.27	.	.	.
WAS	2	FDP	0	2B7	8.61	19.8	8.26	.	.	.
WAS	2	FDP	400	2B8	8.04	19.7	8.01	.	.	.
WAS	2	FDP	400	2B5	8.12	19.7	7.97	.	.	.
WAS	2	FDP	400	2A7	6.77	19.2	7.82	.	.	.
WAS	2	FDP	400	2A5	8.03	19.4	7.91	.	.	.
WAS	2	FDP	50	2A1	7.84	19.8	8.03	.	.	.
WAS	2	FDP	50	2A12	8.09	19.3	8.04	.	.	.
WAS	2	FDP	50	2B2	8.52	19.6	8.18	.	.	.
WAS	2	FDP	50	2B11	8.66	19.6	8.23	.	.	.
WAS	2	FDP	100	2B12	8.50	19.7	8.20	.	.	.
WAS	2	FDP	100	2B9	8.17	19.6	8.06	.	.	.
WAS	2	FDP	100	2A3	8.13	19.4	8.00	.	.	.
WAS	2	FDP	100	2A2	7.96	19.6	8.02	.	.	.
WAS	2	FDP	200	2A6	7.60	19.4	7.93	.	.	.
WAS	2	FDP	200	2A10	7.50	19.2	7.93	.	.	.
WAS	2	FDP	200	2B3	7.89	19.7	7.98	.	.	.
WAS	2	FDP	200	2B10	8.22	19.4	8.08	.	.	.
WAS	2	FDP	300	2B6	7.17	19.8	7.86	.	.	.
WAS	2	FDP	300	2B4	7.38	19.7	7.91	.	.	.
WAS	2	FDP	300	2A8	7.55	19.0	7.91	.	.	.
WAS	2	FDP	300	2A4	7.08	19.4	7.85	.	.	.
FAM	1	SDP	0	1B5	8.57	19.2	7.98	.	.	.
FAM	1	SDP	0	1A1	8.65	19.1	8.16	.	.	.
FAM	1	SDP	0	1B10	8.51	19.1	7.98	.	.	.
FAM	1	SDP	0	1A7	8.66	19.1	8.13	.	.	.

FAM	1	SDP	400	1B2	8.38	19.1	7.83	.	.	.
FAM	1	SDP	400	1A6	8.51	18.9	8.04	.	.	.
FAM	1	SDP	400	1B8	8.48	19.0	7.80	.	.	.
FAM	1	SDP	400	1A8	8.65	19.0	7.97	.	.	.
FAM	1	SDP	50	1B1	8.41	19.2	7.99	.	.	.
FAM	1	SDP	50	1B6	8.57	19.1	8.04	.	.	.
FAM	1	SDP	50	1A3	8.58	19.0	8.09	.	.	.
FAM	1	SDP	50	1A9	8.63	19.0	8.15	.	.	.
FAM	1	SDP	100	1B3	8.65	19.1	8.00	.	.	.
FAM	1	SDP	100	1A2	8.53	19.0	8.05	.	.	.
FAM	1	SDP	100	1B11	8.52	19.1	7.98	.	.	.
FAM	1	SDP	100	1A11	8.56	19.1	8.07	.	.	.
FAM	1	SDP	200	1A5	8.58	18.9	7.95	.	.	.
FAM	1	SDP	200	1B7	8.64	19.0	7.99	.	.	.
FAM	1	SDP	200	1A12	8.58	19.1	8.00	.	.	.
FAM	1	SDP	200	1B9	8.52	19.1	7.92	.	.	.
FAM	1	SDP	300	1A4	8.63	18.7	7.95	.	.	.
FAM	1	SDP	300	1B4	8.62	18.8	7.91	.	.	.
FAM	1	SDP	300	1A10	8.61	18.8	7.94	.	.	.
FAM	1	SDP	300	1B12	8.64	18.9	7.93	.	.	.
FAM	2	SDP	0	1A1	8.83	19.1	8.27	.	.	.
FAM	2	SDP	0	1A7	8.91	18.7	8.31	.	.	.
FAM	2	SDP	0	1B5	8.72	19.2	8.35	.	.	.
FAM	2	SDP	0	1B10	8.61	19.3	8.33	.	.	.
FAM	2	SDP	400	1A6	8.12	18.5	8.12	.	.	.
FAM	2	SDP	400	1A8	6.31	19.0	7.81	.	.	.
FAM	2	SDP	400	1B2	7.71	19.2	8.08	.	.	.
FAM	2	SDP	400	1B8	6.02	19.1	7.83	.	.	.
FAM	2	SDP	50	1A3	8.52	19.0	8.18	.	.	.
FAM	2	SDP	50	1A9	8.76	19.0	8.28	.	.	.
FAM	2	SDP	50	1B1	8.24	19.4	8.15	.	.	.
FAM	2	SDP	50	1B6	8.61	19.2	8.25	.	.	.
FAM	2	SDP	100	1A2	8.30	19.0	8.14	.	.	.
FAM	2	SDP	100	1A11	8.39	19.2	8.19	.	.	.
FAM	2	SDP	100	1B3	8.25	19.2	8.14	.	.	.
FAM	2	SDP	100	1B11	8.50	19.2	8.23	.	.	.
FAM	2	SDP	200	1A5	8.49	18.5	8.17	.	.	.
FAM	2	SDP	200	1A12	8.06	19.3	8.13	.	.	.
FAM	2	SDP	200	1B7	7.81	19.0	7.99	.	.	.
FAM	2	SDP	200	1B9	6.94	19.3	7.95	.	.	.
FAM	2	SDP	300	1A4	6.52	18.7	7.81	.	.	.
FAM	2	SDP	300	1A10	6.58	19.2	7.82	.	.	.
FAM	2	SDP	300	1B4	6.96	19.2	7.92	.	.	.
FAM	2	SDP	300	1B12	7.45	19.4	8.03	.	.	.
BLS	1	SDP	0	2A6	8.79	19.4	8.02	.	.	.
BLS	1	SDP	0	2A8	8.81	19.2	8.04	.	.	.
BLS	1	SDP	0	2B9	8.79	19.4	8.05	.	.	.
BLS	1	SDP	0	2B11	8.76	19.5	8.06	.	.	.
BLS	1	SDP	50	2A9	8.82	19.3	8.04	.	.	.
BLS	1	SDP	50	2A12	8.79	19.4	8.07	.	.	.
BLS	1	SDP	50	2B5	8.75	19.6	8.04	.	.	.
BLS	1	SDP	50	2B8	8.76	19.6	8.06	.	.	.

BLS	1	SDP	100	2A3	8.79	19.3	7.99	.	.	.
BLS	1	SDP	100	2A5	8.88	19.3	8.05	.	.	.
BLS	1	SDP	100	2B2	8.78	19.4	8.02	.	.	.
BLS	1	SDP	100	2B7	8.79	19.5	8.03	.	.	.
BLS	1	SDP	200	2A1	8.77	19.6	7.95	.	.	.
BLS	1	SDP	200	2A4	8.81	19.3	7.95	.	.	.
BLS	1	SDP	200	2B6	8.78	19.4	7.96	.	.	.
BLS	1	SDP	200	2B12	8.79	19.4	7.98	.	.	.
BLS	1	SDP	300	2A10	8.87	19.2	7.91	.	.	.
BLS	1	SDP	300	2A11	8.84	19.2	7.91	.	.	.
BLS	1	SDP	300	2B1	8.78	19.5	7.91	.	.	.
BLS	1	SDP	300	2B4	8.77	19.5	7.92	.	.	.
BLS	1	SDP	400	2A2	8.74	19.6	7.90	.	.	.
BLS	1	SDP	400	2A7	8.79	19.3	7.85	.	.	.
BLS	1	SDP	400	2B3	8.76	19.5	7.94	.	.	.
BLS	1	SDP	400	2B10	8.78	19.4	7.87	.	.	.
BLS	2	SDP	0	2A6	8.34	19.8	8.39	.	.	.
BLS	2	SDP	0	2A8	8.69	19.5	8.43	.	.	.
BLS	2	SDP	0	2B9	8.79	19.4	8.38	.	.	.
BLS	2	SDP	0	2B11	8.91	19.8	8.40	.	.	.
BLS	2	SDP	50	2A9	8.75	19.4	8.33	.	.	.
BLS	2	SDP	50	2A12	8.64	19.6	8.32	.	.	.
BLS	2	SDP	50	2B5	8.62	19.9	8.25	.	.	.
BLS	2	SDP	50	2B8	8.87	19.7	8.24	.	.	.
BLS	2	SDP	100	2A3	7.95	19.9	8.07	.	.	.
BLS	2	SDP	100	2A5	8.78	19.8	8.32	.	.	.
BLS	2	SDP	100	2B2	8.21	19.8	8.20	.	.	.
BLS	2	SDP	100	2B7	7.97	19.9	8.16	.	.	.
BLS	2	SDP	200	2A1	7.39	20.1	8.04	.	.	.
BLS	2	SDP	200	2A4	7.22	19.9	7.98	.	.	.
BLS	2	SDP	200	2B6	7.63	19.9	8.07	.	.	.
BLS	2	SDP	200	2B12	7.60	19.9	8.05	.	.	.
BLS	2	SDP	300	2A10	6.78	19.6	7.97	.	.	.
BLS	2	SDP	300	2A11	7.31	19.5	8.05	.	.	.
BLS	2	SDP	300	2B1	5.85	19.9	7.84	.	.	.
BLS	2	SDP	300	2B4	6.90	19.8	7.97	.	.	.
BLS	2	SDP	400	2A2	7.72	19.9	8.13	.	.	.
BLS	2	SDP	400	2A7	6.06	19.7	7.88	.	.	.
BLS	2	SDP	400	2B3	7.83	19.7	8.15	.	.	.
BLS	2	SDP	400	2B10	7.09	19.4	8.00	.	.	.
PPB	1	SDP	0	1A1	8.54	20.1	8.31	.	.	.
PPB	1	SDP	0	1A3	8.74	19.8	8.38	.	.	.
PPB	1	SDP	0	1B9	8.80	19.6	8.36	.	.	.
PPB	1	SDP	0	1B10	8.76	19.8	8.37	.	.	.
PPB	1	SDP	400	1A2	8.79	19.6	8.37	.	.	.
PPB	1	SDP	400	1A4	8.72	19.7	8.28	.	.	.
PPB	1	SDP	400	1B1	8.63	19.6	8.26	.	.	.
PPB	1	SDP	400	1B4	8.78	19.6	8.31	.	.	.
PPB	1	SDP	50	1A8	8.74	19.7	8.34	.	.	.
PPB	1	SDP	50	1A10	8.75	19.7	8.36	.	.	.
PPB	1	SDP	50	1B3	8.73	19.6	8.36	.	.	.
PPB	1	SDP	50	1B8	8.79	19.6	8.36	.	.	.

PPB	1	SDP	100	1A6	8.78	19.5	8.33	.	.	.
PPB	1	SDP	100	1A7	8.71	19.7	8.31	.	.	.
PPB	1	SDP	100	1B5	8.74	19.7	8.32	.	.	.
PPB	1	SDP	100	1B7	8.80	19.5	8.34	.	.	.
PPB	1	SDP	200	1A5	8.79	19.6	8.29	.	.	.
PPB	1	SDP	200	1A11	8.75	19.8	8.30	.	.	.
PPB	1	SDP	200	1B6	8.80	19.6	8.31	.	.	.
PPB	1	SDP	200	1B12	8.65	19.8	8.29	.	.	.
PPB	1	SDP	300	1A9	8.79	19.5	8.34	.	.	.
PPB	1	SDP	300	1A12	8.51	19.8	8.25	.	.	.
PPB	1	SDP	300	1B2	8.77	19.6	8.29	.	.	.
PPB	1	SDP	300	1B11	8.76	19.7	8.30	.	.	.
PPB	2	SDP	0	1A1	8.59	20.0	8.28	.	.	.
PPB	2	SDP	0	1A3	8.83	19.9	8.35	.	.	.
PPB	2	SDP	0	1B9	8.68	19.8	8.34	.	.	.
PPB	2	SDP	0	1B10	8.67	19.9	8.32	.	.	.
PPB	2	SDP	400	1A2	8.28	19.9	8.19	.	.	.
PPB	2	SDP	400	1A4	6.70	19.8	7.88	.	.	.
PPB	2	SDP	400	1B1	7.29	19.7	8.00	.	.	.
PPB	2	SDP	400	1B4	7.37	19.7	7.99	.	.	.
PPB	2	SDP	50	1A8	8.55	19.8	8.31	.	.	.
PPB	2	SDP	50	1A10	8.20	19.9	8.21	.	.	.
PPB	2	SDP	50	1B3	8.46	19.7	8.29	.	.	.
PPB	2	SDP	50	1B8	8.41	19.8	8.29	.	.	.
PPB	2	SDP	100	1A6	7.45	19.6	8.00	.	.	.
PPB	2	SDP	100	1A7	8.41	19.6	8.25	.	.	.
PPB	2	SDP	100	1B5	8.21	19.7	8.20	.	.	.
PPB	2	SDP	100	1B7	8.32	19.7	8.22	.	.	.
PPB	2	SDP	200	1A5	7.36	19.7	7.96	.	.	.
PPB	2	SDP	200	1A11	7.49	19.9	8.01	.	.	.
PPB	2	SDP	200	1B6	7.47	19.7	8.03	.	.	.
PPB	2	SDP	200	1B12	6.99	20.2	7.96	.	.	.
PPB	2	SDP	300	1A9	7.41	19.8	7.98	.	.	.
PPB	2	SDP	300	1A12	7.91	20.0	8.13	.	.	.
PPB	2	SDP	300	1B2	6.85	19.7	7.97	.	.	.
PPB	2	SDP	300	1B11	7.33	19.9	8.02	.	.	.
HGE	1	SDP	0	1A1	8.36	19.6	8.13	.	.	.
HGE	1	SDP	0	1A8	8.59	19.5	8.23	.	.	.
HGE	1	SDP	0	1B1	8.55	19.5	8.19	.	.	.
HGE	1	SDP	0	1B8	8.55	19.5	8.21	.	.	.
HGE	1	SDP	400	1A5	8.57	19.9	8.08	.	.	.
HGE	1	SDP	400	1A7	8.48	20.1	8.06	.	.	.
HGE	1	SDP	400	1B7	8.53	19.9	8.03	.	.	.
HGE	1	SDP	400	1B11	8.52	20.0	8.05	.	.	.
HGE	1	SDP	50	1A6	8.56	19.8	8.18	.	.	.
HGE	1	SDP	50	1A10	8.53	19.9	8.14	.	.	.
HGE	1	SDP	50	1B4	8.39	19.6	8.14	.	.	.
HGE	1	SDP	50	1B10	8.45	19.7	8.16	.	.	.
HGE	1	SDP	100	1A3	8.51	19.8	8.21	.	.	.
HGE	1	SDP	100	1A9	8.50	19.7	8.15	.	.	.
HGE	1	SDP	100	1B3	8.59	19.7	8.16	.	.	.
HGE	1	SDP	100	1B9	8.58	19.7	8.20	.	.	.

HGE	1	SDP	200	1A4	8.48	19.9	8.09	.	.	.
HGE	1	SDP	200	1A11	8.44	19.9	8.10	.	.	.
HGE	1	SDP	200	1B2	8.51	19.8	8.07	.	.	.
HGE	1	SDP	200	1B5	8.50	19.7	8.11	.	.	.
HGE	1	SDP	300	1A2	8.51	19.7	8.13	.	.	.
HGE	1	SDP	300	1A12	8.45	19.8	8.11	.	.	.
HGE	1	SDP	300	1B6	8.58	19.7	8.07	.	.	.
HGE	1	SDP	300	1B12	8.54	19.8	8.04	.	.	.
HGE	2	SDP	0	1A1	8.40	20.1	8.36	.	.	.
HGE	2	SDP	0	1A8	8.42	20.1	8.39	.	.	.
HGE	2	SDP	0	1B1	8.44	20.1	8.38	.	.	.
HGE	2	SDP	0	1B8	8.49	20.0	8.40	.	.	.
HGE	2	SDP	400	1A5	7.69	20.0	8.06	.	.	.
HGE	2	SDP	400	1A7	7.88	20.0	8.14	.	.	.
HGE	2	SDP	400	1B7	7.24	20.0	7.97	.	.	.
HGE	2	SDP	400	1B11	7.08	20.2	7.98	.	.	.
HGE	2	SDP	50	1A6	8.11	20.0	8.28	.	.	.
HGE	2	SDP	50	1A10	8.17	20.1	8.25	.	.	.
HGE	2	SDP	50	1B4	7.90	20.0	8.10	.	.	.
HGE	2	SDP	50	1B10	8.02	20.1	8.19	.	.	.
HGE	2	SDP	100	1A3	8.20	20.0	8.26	.	.	.
HGE	2	SDP	100	1A9	7.96	20.1	8.21	.	.	.
HGE	2	SDP	100	1B3	7.90	20.0	8.22	.	.	.
HGE	2	SDP	100	1B9	8.10	20.0	8.30	.	.	.
HGE	2	SDP	200	1A4	7.59	20.0	8.06	.	.	.
HGE	2	SDP	200	1A11	6.94	20.2	7.91	.	.	.
HGE	2	SDP	200	1B2	6.84	20.0	7.93	.	.	.
HGE	2	SDP	200	1B5	7.51	20.0	8.04	.	.	.
HGE	2	SDP	300	1A2	6.89	20.0	7.83	.	.	.
HGE	2	SDP	300	1A12	7.52	20.2	8.05	.	.	.
HGE	2	SDP	300	1B6	7.11	20.0	7.89	.	.	.
HGE	2	SDP	300	1B12	6.13	20.4	7.81	.	.	.
HIC	3	FDP	0	.	.	.	.	184	128	389
HIC	3	FDP	50	.	.	.	.	178	135	394
HIC	3	FDP	100	.	.	.	.	184	140	409
HIC	3	FDP	200	.	.	.	.	182	153	438
HIC	3	FDP	300	.	.	.	.	176	163	464
HIC	3	FDP	400	.	.	.	.	177	163	470
MUC	3	FDP	0	.	.	.	.	176	129	397
MUC	3	FDP	50	.	.	.	.	184	138	414
MUC	3	FDP	100	.	.	.	.	178	154	430
MUC	3	FDP	200	.	.	.	.	178	144	455
MUC	3	FDP	300	.	.	.	.	179	166	484
MUC	3	FDP	400	.	.	.	.	178	163	486
WAS	3	FDP	0	.	.	.	.	188	133	396
WAS	3	FDP	50	.	.	.	.	190	138	405
WAS	3	FDP	100	.	.	.	.	188	143	416
WAS	3	FDP	200	.	.	.	.	192	154	435
WAS	3	FDP	300	.	.	.	.	188	159	451
WAS	3	FDP	400	.	.	.	.	188	162	471
FAM	3	SDP	0	.	.	.	.	190	131	395
FAM	3	SDP	50	.	.	.	.	192	140	415

FAM	3	SDP	100	.	.	.	.	196	143	417
FAM	3	SDP	200	.	.	.	.	198	156	439
FAM	3	SDP	300	.	.	.	.	196	160	455
FAM	3	SDP	400	.	.	.	.	180	160	456
BLS	3	SDP	0	.	.	.	.	184	129	386
BLS	3	SDP	50	.	.	.	.	184	136	398
BLS	3	SDP	100	.	.	.	.	184	140	405
BLS	3	SDP	200	.	.	.	.	182	151	407
BLS	3	SDP	300	.	.	.	.	184	161	430
BLS	3	SDP	400	.	.	.	.	182	161	430
PPB	3	SDP	0	.	.	.	.	178	131	376
PPB	3	SDP	50	.	.	.	.	178	133	381
PPB	3	SDP	100	.	.	.	.	184	139	378
PPB	3	SDP	200	.	.	.	.	181	146	382
PPB	3	SDP	300	.	.	.	.	182	152	385
PPB	3	SDP	400	.	.	.	.	180	157	389
HGE	3	SDP	0	.	.	.	.	176	130	365
HGE	3	SDP	50	.	.	.	.	178	133	375
HGE	3	SDP	100	.	.	.	.	180	140	382
HGE	3	SDP	200	.	.	.	.	180	145	398
HGE	3	SDP	300	.	.	.	.	178	148	410
HGE	3	SDP	400	.	.	.	.	178	149	408

FF # 10
Item No. 1
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Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical analysis of exposure period water chemistry
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW KLW

AEH-11-PSEUDO-02

Obs	sps	time	form	conc	id	do	temp	ph	hard	alk	cond
1	HIC	0	FDP	.	.	8.330	21.0	8.21	172	118	374
2	HIC	1	FDP	0	1A2	8.500	20.1	8.23	.	.	.
3	HIC	1	FDP	0	1A5	8.540	20.1	8.24	.	.	.
4	HIC	1	FDP	0	1B12	8.470	20.2	8.20	.	.	.
5	HIC	1	FDP	0	1B2	8.530	20.0	8.22	.	.	.
6	HIC	1	FDP	100	1A6	8.540	20.0	8.20	.	.	.
7	HIC	1	FDP	100	1A9	8.460	20.2	8.17	.	.	.
8	HIC	1	FDP	100	1B10	8.460	20.1	8.17	.	.	.
9	HIC	1	FDP	100	1B3	8.480	19.9	8.15	.	.	.
10	HIC	1	FDP	200	1A1	8.550	19.9	8.20	.	.	.
11	HIC	1	FDP	200	1A11	8.520	20.1	8.17	.	.	.
12	HIC	1	FDP	200	1B5	8.450	20.0	8.14	.	.	.
13	HIC	1	FDP	200	1B8	8.420	20.1	8.09	.	.	.
14	HIC	1	FDP	300	1A12	8.360	20.1	8.06	.	.	.
15	HIC	1	FDP	300	1A3	8.500	19.8	8.11	.	.	.
16	HIC	1	FDP	300	1B1	8.560	19.8	8.10	.	.	.
17	HIC	1	FDP	300	1B4	8.540	19.9	8.09	.	.	.
18	HIC	1	FDP	400	1A10	8.480	20.2	8.06	.	.	.
19	HIC	1	FDP	400	1A8	8.490	20.1	8.05	.	.	.
20	HIC	1	FDP	400	1B6	8.460	20.1	8.01	.	.	.
21	HIC	1	FDP	400	1B7	8.460	20.1	7.99	.	.	.
22	HIC	1	FDP	50	1A4	8.450	19.9	8.20	.	.	.
23	HIC	1	FDP	50	1A7	8.430	20.1	8.19	.	.	.
24	HIC	1	FDP	50	1B11	8.550	20.1	8.21	.	.	.
25	HIC	1	FDP	50	1B9	8.490	20.1	8.19	.	.	.
26	HIC	2	FDP	0	1A2	8.750	18.3	8.30	.	.	.
27	HIC	2	FDP	0	1A5	8.980	18.2	8.33	.	.	.
28	HIC	2	FDP	0	1B12	8.640	18.7	8.33	.	.	.
29	HIC	2	FDP	0	1B2	8.390	18.2	8.35	.	.	.
30	HIC	2	FDP	100	1A6	8.350	18.3	8.17	.	.	.

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31	HIC	2	FDP	100	1A9	7.760	18.5	8.17	.	.	.
32	HIC	2	FDP	100	1B10	6.450	18.5	8.16	.	.	.
33	HIC	2	FDP	100	1B3	6.410	18.3	8.06	.	.	.
34	HIC	2	FDP	200	1A1	8.200	18.3	8.21	.	.	.
35	HIC	2	FDP	200	1A11	8.090	18.5	8.17	.	.	.
36	HIC	2	FDP	200	1B5	6.390	18.3	8.08	.	.	.
37	HIC	2	FDP	200	1B8	7.320	18.4	8.14	.	.	.
38	HIC	2	FDP	300	1A12	6.280	18.7	8.03	.	.	.
39	HIC	2	FDP	300	1A3	6.420	18.2	8.04	.	.	.
40	HIC	2	FDP	300	1B1	6.460	18.2	7.99	.	.	.
41	HIC	2	FDP	300	1B4	5.860	18.3	7.95	.	.	.
42	HIC	2	FDP	400	1A10	6.030	18.5	8.00	.	.	.
43	HIC	2	FDP	400	1A8	6.210	18.6	8.00	.	.	.
44	HIC	2	FDP	400	1B6	7.830	18.3	8.02	.	.	.
45	HIC	2	FDP	400	1B7	7.650	18.3	7.97	.	.	.
46	HIC	2	FDP	50	1A4	8.240	18.2	8.26	.	.	.
47	HIC	2	FDP	50	1A7	8.090	18.5	8.22	.	.	.
48	HIC	2	FDP	50	1B11	8.080	18.6	8.27	.	.	.
49	HIC	2	FDP	50	1B9	7.690	18.5	8.24	.	.	.
50	HIC	3	FDP	0	.	.	.	.	184	128	389
51	HIC	3	FDP	100	.	.	.	.	184	140	409
52	HIC	3	FDP	200	.	.	.	.	182	153	438
53	HIC	3	FDP	300	.	.	.	.	176	163	464
54	HIC	3	FDP	400	.	.	.	.	177	163	470
55	HIC	3	FDP	50	.	.	.	.	178	135	394
56	MUC	0	FDP	.	.	8.770	20.6	8.24	179	130	371
57	MUC	1	FDP	0	2A11	8.420	19.7	8.14	.	.	.
58	MUC	1	FDP	0	2A4	8.310	20.1	8.15	.	.	.
59	MUC	1	FDP	0	2B10	8.450	19.7	8.18	.	.	.
60	MUC	1	FDP	0	2B7	8.410	19.8	8.18	.	.	.
61	MUC	1	FDP	100	2A6	8.330	19.8	8.09	.	.	.
62	MUC	1	FDP	100	2A7	8.440	19.7	8.15	.	.	.
63	MUC	1	FDP	100	2B3	8.460	19.8	8.15	.	.	.
64	MUC	1	FDP	100	2B8	8.340	19.7	8.14	.	.	.
65	MUC	1	FDP	200	2A1	8.420	19.7	8.07	.	.	.

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	MUC	1	FDP	200	2A5	8.440	19.7	8.13	.	.	.
67	MUC	1	FDP	200	2B11	8.460	19.6	8.09	.	.	.
68	MUC	1	FDP	200	2B12	8.420	19.6	8.04	.	.	.
69	MUC	1	FDP	300	2A2	8.400	19.8	8.08	.	.	.
70	MUC	1	FDP	300	2A9	8.420	19.6	8.04	.	.	.
71	MUC	1	FDP	300	2B2	8.430	19.7	8.04	.	.	.
72	MUC	1	FDP	300	2B4	8.400	19.7	8.02	.	.	.
73	MUC	1	FDP	400	2A12	8.460	19.4	7.96	.	.	.
74	MUC	1	FDP	400	2A8	8.350	19.7	7.96	.	.	.
75	MUC	1	FDP	400	2B1	8.410	19.6	7.93	.	.	.
76	MUC	1	FDP	400	2B6	8.420	19.8	7.95	.	.	.
77	MUC	1	FDP	50	2A10	8.370	19.7	8.14	.	.	.
78	MUC	1	FDP	50	2A3	8.380	20.1	8.15	.	.	.
79	MUC	1	FDP	50	2B5	8.370	19.8	8.14	.	.	.
80	MUC	1	FDP	50	2B9	8.410	19.6	8.14	.	.	.
81	MUC	2	FDP	0	2A11	8.920	18.3	8.30	.	.	.
82	MUC	2	FDP	0	2A4	8.780	18.8	8.12	.	.	.
83	MUC	2	FDP	0	2B10	8.970	18.2	8.35	.	.	.
84	MUC	2	FDP	0	2B7	8.970	18.3	8.32	.	.	.
85	MUC	2	FDP	100	2A6	8.570	18.7	8.21	.	.	.
86	MUC	2	FDP	100	2A7	8.730	18.6	8.26	.	.	.
87	MUC	2	FDP	100	2B3	8.790	18.4	8.30	.	.	.
88	MUC	2	FDP	100	2B8	8.710	18.3	8.27	.	.	.
89	MUC	2	FDP	200	2A1	8.490	18.9	8.23	.	.	.
90	MUC	2	FDP	200	2A5	8.270	18.7	8.13	.	.	.
91	MUC	2	FDP	200	2B11	8.310	18.4	8.13	.	.	.
92	MUC	2	FDP	200	2B12	8.230	18.6	8.13	.	.	.
93	MUC	2	FDP	300	2A2	8.120	18.8	8.12	.	.	.
94	MUC	2	FDP	300	2A9	8.020	18.5	8.07	.	.	.
95	MUC	2	FDP	300	2B2	8.180	18.4	8.10	.	.	.
96	MUC	2	FDP	300	2B4	7.290	18.5	7.98	.	.	.
97	MUC	2	FDP	400	2A12	7.450	18.3	7.96	.	.	.
98	MUC	2	FDP	400	2A8	7.670	18.4	8.00	.	.	.
99	MUC	2	FDP	400	2B1	7.640	18.5	7.98	.	.	.
100	MUC	2	FDP	400	2B6	7.740	18.3	8.01	.	.	.

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	MUC	2	FDP	50	2A10	8.550	18.3	8.18	.	.	.
102	MUC	2	FDP	50	2A3	8.650	18.8	8.26	.	.	.
103	MUC	2	FDP	50	2B5	8.590	18.5	8.22	.	.	.
104	MUC	2	FDP	50	2B9	8.760	18.2	8.25	.	.	.
105	MUC	3	FDP	0	.	.	.	.	176	129	397
106	MUC	3	FDP	100	.	.	.	.	178	154	430
107	MUC	3	FDP	200	.	.	.	.	178	144	455
108	MUC	3	FDP	300	.	.	.	.	179	166	484
109	MUC	3	FDP	400	.	.	.	.	178	163	486
110	MUC	3	FDP	50	.	.	.	.	184	138	414
111	WAS	0	FDP	.	.	8.700	20.1	8.20	178	125	387
112	WAS	1	FDP	0	2A11	8.120	19.8	8.05	.	.	.
113	WAS	1	FDP	0	2A9	8.100	19.7	8.14	.	.	.
114	WAS	1	FDP	0	2B1	8.470	19.8	8.05	.	.	.
115	WAS	1	FDP	0	2B7	8.650	19.6	8.07	.	.	.
116	WAS	1	FDP	100	2A2	8.320	20.0	8.04	.	.	.
117	WAS	1	FDP	100	2A3	8.100	20.0	7.99	.	.	.
118	WAS	1	FDP	100	2B12	8.540	19.9	8.11	.	.	.
119	WAS	1	FDP	100	2B9	8.430	19.7	8.02	.	.	.
120	WAS	1	FDP	200	2A10	8.110	19.8	7.97	.	.	.
121	WAS	1	FDP	200	2A6	8.370	19.9	7.99	.	.	.
122	WAS	1	FDP	200	2B10	8.550	19.6	8.05	.	.	.
123	WAS	1	FDP	200	2B3	8.450	19.8	8.01	.	.	.
124	WAS	1	FDP	300	2A4	8.390	19.7	7.95	.	.	.
125	WAS	1	FDP	300	2A8	8.380	19.7	7.97	.	.	.
126	WAS	1	FDP	300	2B4	8.470	19.6	7.99	.	.	.
127	WAS	1	FDP	300	2B6	8.350	19.6	7.97	.	.	.
128	WAS	1	FDP	400	2A5	8.440	19.8	7.89	.	.	.
129	WAS	1	FDP	400	2A7	8.520	19.8	7.82	.	.	.
130	WAS	1	FDP	400	2B5	8.550	19.7	7.96	.	.	.
131	WAS	1	FDP	400	2B8	8.530	19.5	7.89	.	.	.
132	WAS	1	FDP	50	2A1	8.240	19.6	7.98	.	.	.
133	WAS	1	FDP	50	2A12	8.300	19.6	7.96	.	.	.
134	WAS	1	FDP	50	2B11	8.620	19.4	8.11	.	.	.
135	WAS	1	FDP	50	2B2	8.520	19.6	8.05	.	.	.

	WAS	2	FDP	0	2A11	8.630	19.2	8.24	.	.	.
137	WAS	2	FDP	0	2A9	8.690	19.2	8.27	.	.	.
138	WAS	2	FDP	0	2B1	8.590	19.9	8.27	.	.	.
139	WAS	2	FDP	0	2B7	8.610	19.8	8.26	.	.	.
140	WAS	2	FDP	100	2A2	7.960	19.6	8.02	.	.	.
141	WAS	2	FDP	100	2A3	8.130	19.4	8.00	.	.	.
142	WAS	2	FDP	100	2B12	8.500	19.7	8.20	.	.	.
143	WAS	2	FDP	100	2B9	8.170	19.6	8.06	.	.	.
144	WAS	2	FDP	200	2A10	7.500	19.2	7.93	.	.	.
145	WAS	2	FDP	200	2A6	7.600	19.4	7.93	.	.	.
146	WAS	2	FDP	200	2B10	8.220	19.4	8.08	.	.	.
147	WAS	2	FDP	200	2B3	7.890	19.7	7.98	.	.	.
148	WAS	2	FDP	300	2A4	7.080	19.4	7.85	.	.	.
149	WAS	2	FDP	300	2A8	7.550	19.0	7.91	.	.	.
150	WAS	2	FDP	300	2B4	7.380	19.7	7.91	.	.	.
151	WAS	2	FDP	300	2B6	7.170	19.8	7.86	.	.	.
152	WAS	2	FDP	400	2A5	8.030	19.4	7.91	.	.	.
153	WAS	2	FDP	400	2A7	6.770	19.2	7.82	.	.	.
154	WAS	2	FDP	400	2B5	8.120	19.7	7.97	.	.	.
155	WAS	2	FDP	400	2B8	8.040	19.7	8.01	.	.	.
156	WAS	2	FDP	50	2A1	7.840	19.8	8.03	.	.	.
157	WAS	2	FDP	50	2A12	8.090	19.3	8.04	.	.	.
158	WAS	2	FDP	50	2B11	8.660	19.6	8.23	.	.	.
159	WAS	2	FDP	50	2B2	8.520	19.6	8.18	.	.	.
160	WAS	3	FDP	0	.	.	.	.	188	133	396
161	WAS	3	FDP	100	.	.	.	.	188	143	416
162	WAS	3	FDP	200	.	.	.	.	192	154	435
163	WAS	3	FDP	300	.	.	.	.	188	159	451
164	WAS	3	FDP	400	.	.	.	.	188	162	471
165	WAS	3	FDP	50	.	.	.	.	190	138	405
166	BLS	0	SDP	.	.	8.770	19.9	8.32	180	125	376
167	BLS	1	SDP	0	2A6	8.790	19.4	8.02	.	.	.
168	BLS	1	SDP	0	2A8	8.810	19.2	8.04	.	.	.
169	BLS	1	SDP	0	2B11	8.760	19.5	8.06	.	.	.
170	BLS	1	SDP	0	2B9	8.790	19.4	8.05	.	.	.

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	BLS	1	SDP	100	2A3	8.790	19.3	7.99	.	.	.
172	BLS	1	SDP	100	2A5	8.880	19.3	8.05	.	.	.
173	BLS	1	SDP	100	2B2	8.780	19.4	8.02	.	.	.
174	BLS	1	SDP	100	2B7	8.790	19.5	8.03	.	.	.
175	BLS	1	SDP	200	2A1	8.770	19.6	7.95	.	.	.
176	BLS	1	SDP	200	2A4	8.810	19.3	7.95	.	.	.
177	BLS	1	SDP	200	2B12	8.790	19.4	7.98	.	.	.
178	BLS	1	SDP	200	2B6	8.780	19.4	7.96	.	.	.
179	BLS	1	SDP	300	2A10	8.870	19.2	7.91	.	.	.
180	BLS	1	SDP	300	2A11	8.840	19.2	7.91	.	.	.
181	BLS	1	SDP	300	2B1	8.780	19.5	7.91	.	.	.
182	BLS	1	SDP	300	2B4	8.770	19.5	7.92	.	.	.
183	BLS	1	SDP	400	2A2	8.740	19.6	7.90	.	.	.
184	BLS	1	SDP	400	2A7	8.790	19.3	7.85	.	.	.
185	BLS	1	SDP	400	2B10	8.783	19.4	7.87	.	.	.
186	BLS	1	SDP	400	2B3	8.760	19.5	7.94	.	.	.
187	BLS	1	SDP	50	2A12	8.790	19.4	8.07	.	.	.
188	BLS	1	SDP	50	2A9	8.820	19.3	8.04	.	.	.
189	BLS	1	SDP	50	2B5	8.750	19.6	8.04	.	.	.
190	BLS	1	SDP	50	2B8	8.760	19.6	8.06	.	.	.
191	BLS	2	SDP	0	2A6	8.340	19.8	8.39	.	.	.
192	BLS	2	SDP	0	2A8	8.690	19.5	8.43	.	.	.
193	BLS	2	SDP	0	2B11	8.910	19.8	8.40	.	.	.
194	BLS	2	SDP	0	2B9	8.790	19.4	8.38	.	.	.
195	BLS	2	SDP	100	2A3	7.950	19.9	8.07	.	.	.
196	BLS	2	SDP	100	2A5	8.780	19.8	8.32	.	.	.
197	BLS	2	SDP	100	2B2	8.210	19.8	8.20	.	.	.
198	BLS	2	SDP	100	2B7	7.970	19.9	8.16	.	.	.
199	BLS	2	SDP	200	2A1	7.390	20.1	8.04	.	.	.
200	BLS	2	SDP	200	2A4	7.220	19.9	7.98	.	.	.
201	BLS	2	SDP	200	2B12	7.600	19.9	8.05	.	.	.
202	BLS	2	SDP	200	2B6	7.630	19.9	8.07	.	.	.
203	BLS	2	SDP	300	2A10	6.780	19.6	7.97	.	.	.
204	BLS	2	SDP	300	2A11	7.310	19.5	8.05	.	.	.
205	BLS	2	SDP	300	2B1	5.850	19.9	7.84	.	.	.

	BLS	2	SDP	300	2B4	6.900	19.8	7.97	.	.	.
207	BLS	2	SDP	400	2A2	7.720	19.9	8.13	.	.	.
208	BLS	2	SDP	400	2A7	6.060	19.7	7.88	.	.	.
209	BLS	2	SDP	400	2B10	7.090	19.4	8.00	.	.	.
210	BLS	2	SDP	400	2B3	7.830	19.7	8.15	.	.	.
211	BLS	2	SDP	50	2A12	8.640	19.6	8.32	.	.	.
212	BLS	2	SDP	50	2A9	8.750	19.4	8.33	.	.	.
213	BLS	2	SDP	50	2B5	8.620	19.9	8.25	.	.	.
214	BLS	2	SDP	50	2B8	8.870	19.7	8.24	.	.	.
215	BLS	3	SDP	0	.	.	.	.	184	129	386
216	BLS	3	SDP	100	.	.	.	.	184	140	405
217	BLS	3	SDP	200	.	.	.	.	182	151	407
218	BLS	3	SDP	300	.	.	.	.	184	161	430
219	BLS	3	SDP	400	.	.	.	.	182	161	430
220	BLS	3	SDP	50	.	.	.	.	184	136	398
221	FAM	0	SDP	.	.	8.500	20.8	7.68	180	126	396
222	FAM	1	SDP	0	1A1	8.650	19.1	8.16	.	.	.
223	FAM	1	SDP	0	1A7	8.660	19.1	8.13	.	.	.
224	FAM	1	SDP	0	1B10	8.510	19.1	7.98	.	.	.
225	FAM	1	SDP	0	1B5	8.570	19.2	7.98	.	.	.
226	FAM	1	SDP	100	1A11	8.560	19.1	8.07	.	.	.
227	FAM	1	SDP	100	1A2	8.530	19.0	8.05	.	.	.
228	FAM	1	SDP	100	1B11	8.520	19.1	7.98	.	.	.
229	FAM	1	SDP	100	1B3	8.650	19.1	8.00	.	.	.
230	FAM	1	SDP	200	1A12	8.580	19.1	8.00	.	.	.
231	FAM	1	SDP	200	1A5	8.580	18.9	7.95	.	.	.
232	FAM	1	SDP	200	1B7	8.640	19.0	7.99	.	.	.
233	FAM	1	SDP	200	1B9	8.520	19.1	7.92	.	.	.
234	FAM	1	SDP	300	1A10	8.610	18.8	7.94	.	.	.
235	FAM	1	SDP	300	1A4	8.630	18.7	7.95	.	.	.
236	FAM	1	SDP	300	1B12	8.640	18.9	7.93	.	.	.
237	FAM	1	SDP	300	1B4	8.620	18.8	7.91	.	.	.
238	FAM	1	SDP	400	1A6	8.510	18.9	8.04	.	.	.
239	FAM	1	SDP	400	1A8	8.650	19.0	7.97	.	.	.
240	FAM	1	SDP	400	1B2	8.380	19.1	7.83	.	.	.

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	FAM	1	SDP	400	1B8	8.480	19.0	7.80	.	.	.
242	FAM	1	SDP	50	1A3	8.580	19.0	8.09	.	.	.
243	FAM	1	SDP	50	1A9	8.630	19.0	8.15	.	.	.
244	FAM	1	SDP	50	1B1	8.410	19.2	7.99	.	.	.
245	FAM	1	SDP	50	1B6	8.570	19.1	8.04	.	.	.
246	FAM	2	SDP	0	1A1	8.830	19.1	8.27	.	.	.
247	FAM	2	SDP	0	1A7	8.910	18.7	8.31	.	.	.
248	FAM	2	SDP	0	1B10	8.610	19.3	8.33	.	.	.
249	FAM	2	SDP	0	1B5	8.720	19.2	8.35	.	.	.
250	FAM	2	SDP	100	1A11	8.390	19.2	8.19	.	.	.
251	FAM	2	SDP	100	1A2	8.300	19.0	8.14	.	.	.
252	FAM	2	SDP	100	1B11	8.500	19.2	8.23	.	.	.
253	FAM	2	SDP	100	1B3	8.250	19.2	8.14	.	.	.
254	FAM	2	SDP	200	1A12	8.060	19.3	8.13	.	.	.
255	FAM	2	SDP	200	1A5	8.490	18.5	8.17	.	.	.
256	FAM	2	SDP	200	1B7	7.810	19.0	7.99	.	.	.
257	FAM	2	SDP	200	1B9	6.940	19.3	7.95	.	.	.
258	FAM	2	SDP	300	1A10	6.580	19.2	7.82	.	.	.
259	FAM	2	SDP	300	1A4	6.520	18.7	7.81	.	.	.
260	FAM	2	SDP	300	1B12	7.450	19.4	8.03	.	.	.
261	FAM	2	SDP	300	1B4	6.960	19.2	7.92	.	.	.
262	FAM	2	SDP	400	1A6	8.120	18.5	8.12	.	.	.
263	FAM	2	SDP	400	1A8	6.310	19.0	7.81	.	.	.
264	FAM	2	SDP	400	1B2	7.710	19.2	8.08	.	.	.
265	FAM	2	SDP	400	1B8	6.020	19.1	7.83	.	.	.
266	FAM	2	SDP	50	1A3	8.520	19.0	8.18	.	.	.
267	FAM	2	SDP	50	1A9	8.760	19.0	8.28	.	.	.
268	FAM	2	SDP	50	1B1	8.240	19.4	8.15	.	.	.
269	FAM	2	SDP	50	1B6	8.610	19.2	8.25	.	.	.
270	FAM	3	SDP	0	.	.	.	.	190	131	395
271	FAM	3	SDP	100	.	.	.	.	196	143	417
272	FAM	3	SDP	200	.	.	.	.	198	156	439
273	FAM	3	SDP	300	.	.	.	.	196	160	455
274	FAM	3	SDP	400	.	.	.	.	180	160	456
275	FAM	3	SDP	50	.	.	.	.	192	140	415

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	HGE	0	SDP	.	.	8.790	20.5	8.22	174	128	370
277	HGE	1	SDP	0	1A1	8.360	19.6	8.13	.	.	.
278	HGE	1	SDP	0	1A8	8.590	19.5	8.23	.	.	.
279	HGE	1	SDP	0	1B1	8.550	19.5	8.19	.	.	.
280	HGE	1	SDP	0	1B8	8.550	19.5	8.21	.	.	.
281	HGE	1	SDP	100	1A3	8.510	19.8	8.21	.	.	.
282	HGE	1	SDP	100	1A9	8.500	19.7	8.15	.	.	.
283	HGE	1	SDP	100	1B3	8.590	19.7	8.16	.	.	.
284	HGE	1	SDP	100	1B9	8.580	19.7	8.20	.	.	.
285	HGE	1	SDP	200	1A11	8.440	19.9	8.10	.	.	.
286	HGE	1	SDP	200	1A4	8.480	19.9	8.09	.	.	.
287	HGE	1	SDP	200	1B2	8.510	19.8	8.07	.	.	.
288	HGE	1	SDP	200	1B5	8.500	19.7	8.11	.	.	.
289	HGE	1	SDP	300	1A12	8.450	19.8	8.11	.	.	.
290	HGE	1	SDP	300	1A2	8.510	19.7	8.13	.	.	.
291	HGE	1	SDP	300	1B12	8.540	19.8	8.04	.	.	.
292	HGE	1	SDP	300	1B6	8.580	19.7	8.07	.	.	.
293	HGE	1	SDP	400	1A5	8.570	19.9	8.08	.	.	.
294	HGE	1	SDP	400	1A7	8.480	20.1	8.06	.	.	.
295	HGE	1	SDP	400	1B11	8.520	20.0	8.05	.	.	.
296	HGE	1	SDP	400	1B7	8.530	19.9	8.03	.	.	.
297	HGE	1	SDP	50	1A10	8.530	19.9	8.14	.	.	.
298	HGE	1	SDP	50	1A6	8.560	19.8	8.18	.	.	.
299	HGE	1	SDP	50	1B10	8.450	19.7	8.16	.	.	.
300	HGE	1	SDP	50	1B4	8.390	19.6	8.14	.	.	.
301	HGE	2	SDP	0	1A1	8.400	20.1	8.36	.	.	.
302	HGE	2	SDP	0	1A8	8.420	20.1	8.39	.	.	.
303	HGE	2	SDP	0	1B1	8.440	20.1	8.38	.	.	.
304	HGE	2	SDP	0	1B8	8.490	20.0	8.40	.	.	.
305	HGE	2	SDP	100	1A3	8.200	20.0	8.26	.	.	.
306	HGE	2	SDP	100	1A9	7.960	20.1	8.21	.	.	.
307	HGE	2	SDP	100	1B3	7.900	20.0	8.22	.	.	.
308	HGE	2	SDP	100	1B9	8.100	20.0	8.30	.	.	.
309	HGE	2	SDP	200	1A11	6.940	20.2	7.91	.	.	.
310	HGE	2	SDP	200	1A4	7.590	20.0	8.06	.	.	.

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	HGE	2	SDP	200	1B2	6.840	20.0	7.93	.	.	.
312	HGE	2	SDP	200	1B5	7.510	20.0	8.04	.	.	.
313	HGE	2	SDP	300	1A12	7.520	20.2	8.05	.	.	.
314	HGE	2	SDP	300	1A2	6.890	20.0	7.83	.	.	.
315	HGE	2	SDP	300	1B12	6.130	20.4	7.81	.	.	.
316	HGE	2	SDP	300	1B6	7.110	20.0	7.89	.	.	.
317	HGE	2	SDP	400	1A5	7.690	20.0	8.06	.	.	.
318	HGE	2	SDP	400	1A7	7.880	20.0	8.14	.	.	.
319	HGE	2	SDP	400	1B11	7.080	20.2	7.98	.	.	.
320	HGE	2	SDP	400	1B7	7.240	20.0	7.97	.	.	.
321	HGE	2	SDP	50	1A10	8.170	20.1	8.25	.	.	.
322	HGE	2	SDP	50	1A6	8.110	20.0	8.28	.	.	.
323	HGE	2	SDP	50	1B10	8.020	20.1	8.19	.	.	.
324	HGE	2	SDP	50	1B4	7.900	20.0	8.10	.	.	.
325	HGE	3	SDP	0	.	.	.	.	176	130	365
326	HGE	3	SDP	100	.	.	.	.	180	140	382
327	HGE	3	SDP	200	.	.	.	.	180	145	398
328	HGE	3	SDP	300	.	.	.	.	178	148	410
329	HGE	3	SDP	400	.	.	.	.	178	149	408
330	HGE	3	SDP	50	.	.	.	.	178	133	375
331	PPB	0	SDP	.	.	8.330	20.7	8.10	172	128	372
332	PPB	1	SDP	0	1A1	8.540	20.1	8.31	.	.	.
333	PPB	1	SDP	0	1A3	8.740	19.8	8.38	.	.	.
334	PPB	1	SDP	0	1B10	8.760	19.8	8.37	.	.	.
335	PPB	1	SDP	0	1B9	8.800	19.6	8.36	.	.	.
336	PPB	1	SDP	100	1A6	8.780	19.5	8.33	.	.	.
337	PPB	1	SDP	100	1A7	8.710	19.7	8.31	.	.	.
338	PPB	1	SDP	100	1B5	8.740	19.7	8.32	.	.	.
339	PPB	1	SDP	100	1B7	8.800	19.5	8.34	.	.	.
340	PPB	1	SDP	200	1A11	8.750	19.8	8.30	.	.	.
341	PPB	1	SDP	200	1A5	8.790	19.6	8.29	.	.	.
342	PPB	1	SDP	200	1B12	8.650	19.8	8.29	.	.	.
343	PPB	1	SDP	200	1B6	8.800	19.6	8.31	.	.	.
344	PPB	1	SDP	300	1A12	8.510	19.8	8.25	.	.	.
345	PPB	1	SDP	300	1A9	8.790	19.5	8.34	.	.	.

	PPB	1	SDP	300	1B11	8.760	19.7	8.30	.	.	.
347	PPB	1	SDP	300	1B2	8.770	19.6	8.29	.	.	.
348	PPB	1	SDP	400	1A2	8.790	19.6	8.37	.	.	.
349	PPB	1	SDP	400	1A4	8.720	19.7	8.28	.	.	.
350	PPB	1	SDP	400	1B1	8.630	19.6	8.26	.	.	.
351	PPB	1	SDP	400	1B4	8.780	19.6	8.31	.	.	.
352	PPB	1	SDP	50	1A10	8.750	19.7	8.36	.	.	.
353	PPB	1	SDP	50	1A8	8.740	19.7	8.34	.	.	.
354	PPB	1	SDP	50	1B3	8.730	19.6	8.36	.	.	.
355	PPB	1	SDP	50	1B8	8.790	19.6	8.36	.	.	.
356	PPB	2	SDP	0	1A1	8.590	20.0	8.28	.	.	.
357	PPB	2	SDP	0	1A3	8.830	19.9	8.35	.	.	.
358	PPB	2	SDP	0	1B10	8.670	19.9	8.32	.	.	.
359	PPB	2	SDP	0	1B9	8.680	19.8	8.34	.	.	.
360	PPB	2	SDP	100	1A6	7.450	19.6	8.00	.	.	.
361	PPB	2	SDP	100	1A7	8.410	19.6	8.25	.	.	.
362	PPB	2	SDP	100	1B5	8.210	19.7	8.20	.	.	.
363	PPB	2	SDP	100	1B7	8.320	19.7	8.22	.	.	.
364	PPB	2	SDP	200	1A11	7.490	19.9	8.01	.	.	.
365	PPB	2	SDP	200	1A5	7.360	19.7	7.96	.	.	.
366	PPB	2	SDP	200	1B12	6.990	20.2	7.96	.	.	.
367	PPB	2	SDP	200	1B6	7.470	19.7	8.03	.	.	.
368	PPB	2	SDP	300	1A12	7.910	20.0	8.13	.	.	.
369	PPB	2	SDP	300	1A9	7.410	19.8	7.98	.	.	.
370	PPB	2	SDP	300	1B11	7.330	19.9	8.02	.	.	.
371	PPB	2	SDP	300	1B2	6.850	19.7	7.97	.	.	.
372	PPB	2	SDP	400	1A2	8.280	19.9	8.19	.	.	.
373	PPB	2	SDP	400	1A4	6.700	19.8	7.88	.	.	.
374	PPB	2	SDP	400	1B1	7.290	19.7	8.00	.	.	.
375	PPB	2	SDP	400	1B4	7.370	19.7	7.99	.	.	.
376	PPB	2	SDP	50	1A10	8.200	19.9	8.21	.	.	.
377	PPB	2	SDP	50	1A8	8.550	19.8	8.31	.	.	.
378	PPB	2	SDP	50	1B3	8.460	19.7	8.29	.	.	.
379	PPB	2	SDP	50	1B8	8.410	19.8	8.29	.	.	.
380	PPB	3	SDP	0	.	.	.	.	178	131	376

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	PPB	3	SDP	100	.	.	.	.	184	139	378
382	PPB	3	SDP	200	.	.	.	.	181	146	382
383	PPB	3	SDP	300	.	.	.	.	182	152	385
384	PPB	3	SDP	400	.	.	.	.	180	157	389
385	PPB	3	SDP	50	.	.	.	.	178	133	381

Performed by K. Weber SAS version 9.4 10:41 07MAY14 KW

AEH-11-PSEUDO-02

Pre-exposure Period Water Chemistry Means by Species and Formulation
Analyzes dissolved oxygen, temperature, pH, hardness, alkalinity, and conductivity

The MEANS Procedure AEH-11-PSEUDO-02

form=FDP

sps	N Obs	Variable	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
HIC	1	do	8.3300	.	8.3300	8.3300	.	.
		temp	21.0000	.	21.0000	21.0000	.	.
		ph	8.2100	.	8.2100	8.2100	.	.
		hard	172.0	.	172.0	172.0	.	.
		alk	118.0	.	118.0	118.0	.	.
		cond	374.0	.	374.0	374.0	.	.
MUC	1	do	8.7700	.	8.7700	8.7700	.	.
		temp	20.6000	.	20.6000	20.6000	.	.
		ph	8.2400	.	8.2400	8.2400	.	.
		hard	179.0	.	179.0	179.0	.	.
		alk	130.0	.	130.0	130.0	.	.
		cond	371.0	.	371.0	371.0	.	.
WAS	1	do	8.7000	.	8.7000	8.7000	.	.
		temp	20.1000	.	20.1000	20.1000	.	.
		ph	8.2000	.	8.2000	8.2000	.	.
		hard	178.0	.	178.0	178.0	.	.
		alk	125.0	.	125.0	125.0	.	.
		cond	387.0	.	387.0	387.0	.	.

form=SDP

sps	N Obs	Variable	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
BLS	1	do	8.7700	.	8.7700	8.7700	.	.
		temp	19.9000	.	19.9000	19.9000	.	.
		ph	8.3200	.	8.3200	8.3200	.	.
		hard	180.0	.	180.0	180.0	.	.
		alk	125.0	.	125.0	125.0	.	.
		cond	376.0	.	376.0	376.0	.	.
FAM	1	do	8.5000	.	8.5000	8.5000	.	.
		temp	20.8000	.	20.8000	20.8000	.	.
		ph	7.6800	.	7.6800	7.6800	.	.
		hard	180.0	.	180.0	180.0	.	.
		alk	126.0	.	126.0	126.0	.	.
		cond	396.0	.	396.0	396.0	.	.
HGE	1	do	8.7900	.	8.7900	8.7900	.	.
		temp	20.5000	.	20.5000	20.5000	.	.
		ph	8.2200	.	8.2200	8.2200	.	.
		hard	174.0	.	174.0	174.0	.	.
		alk	128.0	.	128.0	128.0	.	.

		cond	370.0	.	370.0	370.0	.	.
PPB	1	do	8.3300	.	8.3300	8.3300	.	.
		temp	20.7000	.	20.7000	20.7000	.	.
		ph	8.1000	.	8.1000	8.1000	.	.
		hard	172.0	.	172.0	172.0	.	.
		alk	128.0	.	128.0	128.0	.	.
		cond	372.0	.	372.0	372.0	.	.

Performed by K. Weber SAS version 9.4 10:41 07MAY14 KW

AEH-11-PSEUDO-02

Exposure Period Water Chemistry Means by Species and Formulation
Only dissolved oxygen, pH, and temperature measured

The MEANS Procedure

AEH-11-PSEUDO-02

form=FDP

sps	conc	N Obs	Variable	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
HIC	0	8	do	8.6000	0.1882	8.3900	8.9800	8.4426	8.7574
			ph	8.2750	0.0588	8.2000	8.3500	8.2258	8.3242
			temp	19.2250	0.9498	18.2000	20.2000	18.4309	20.0191
	100	8	do	7.8638	0.9186	6.4100	8.5400	7.0957	8.6318
			ph	8.1563	0.0414	8.0600	8.2000	8.1217	8.1908
			temp	19.2250	0.8892	18.3000	20.2000	18.4816	19.9684
	200	8	do	7.9925	0.7610	6.3900	8.5500	7.3563	8.6287
			ph	8.1500	0.0472	8.0800	8.2100	8.1105	8.1895
			temp	19.2000	0.8864	18.3000	20.1000	18.4589	19.9411
	300	8	do	7.3725	1.2095	5.8600	8.5600	6.3613	8.3837
			ph	8.0463	0.0558	7.9500	8.1100	7.9996	8.0929
			temp	19.1250	0.8481	18.2000	20.1000	18.4160	19.8340
	400	8	do	7.7013	1.0293	6.0300	8.4900	6.8407	8.5618
			ph	8.0125	0.0301	7.9700	8.0600	7.9873	8.0377
			temp	19.2750	0.9146	18.3000	20.2000	18.5104	20.0396
	50	8	do	8.2525	0.2899	7.6900	8.5500	8.0102	8.4948
			ph	8.2225	0.0311	8.1900	8.2700	8.1965	8.2485
			temp	19.2500	0.8652	18.2000	20.1000	18.5267	19.9733
MUC	0	8	do	8.6538	0.2830	8.3100	8.9700	8.4172	8.8903
			ph	8.2175	0.0908	8.1200	8.3500	8.1416	8.2934
			temp	19.1125	0.7918	18.2000	20.1000	18.4505	19.7745
	100	8	do	8.5463	0.1807	8.3300	8.7900	8.3952	8.6973
			ph	8.1963	0.0748	8.0900	8.3000	8.1337	8.2588
			temp	19.1250	0.6798	18.3000	19.8000	18.5567	19.6933
	200	8	do	8.3800	0.0962	8.2300	8.4900	8.2996	8.4604
			ph	8.1188	0.0564	8.0400	8.2300	8.0716	8.1659
			temp	19.1500	0.5529	18.4000	19.7000	18.6878	19.6122
	300	8	do	8.1575	0.3844	7.2900	8.4300	7.8362	8.4788
			ph	8.0563	0.0453	7.9800	8.1200	8.0183	8.0942
			temp	19.1250	0.6274	18.4000	19.8000	18.6005	19.6495
	400	8	do	8.0175	0.4284	7.4500	8.4600	7.6593	8.3757
			ph	7.9688	0.0264	7.9300	8.0100	7.9467	7.9908
			temp	19.0000	0.6803	18.3000	19.8000	18.4312	19.5688
	50	8	do	8.5100	0.1494	8.3700	8.7600	8.3851	8.6349
			ph	8.1850	0.0513	8.1400	8.2600	8.1421	8.2279
			temp	19.1250	0.7555	18.2000	20.1000	18.4934	19.7566

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WAS	0	8	do	8.4825	0.2386	8.1000	8.6900	8.2830	8.6820
			ph	8.1688	0.1019	8.0500	8.2700	8.0836	8.2539
			temp	19.6250	0.2765	19.2000	19.9000	19.3939	19.8561
	100	8	do	8.2688	0.2099	7.9600	8.5400	8.0932	8.4443
			ph	8.0550	0.0697	7.9900	8.2000	7.9967	8.1133
			temp	19.7375	0.2134	19.4000	20.0000	19.5591	19.9159
	200	8	do	8.0863	0.3901	7.5000	8.5500	7.7602	8.4123
			ph	7.9925	0.0531	7.9300	8.0800	7.9481	8.0369
			temp	19.6000	0.2449	19.2000	19.9000	19.3952	19.8048
	300	8	do	7.8463	0.6063	7.0800	8.4700	7.3394	8.3531
			ph	7.9263	0.0524	7.8500	7.9900	7.8825	7.9700
			temp	19.5625	0.2560	19.0000	19.8000	19.3485	19.7765
	400	8	do	8.1250	0.5919	6.7700	8.5500	7.6302	8.6198
			ph	7.9088	0.0688	7.8200	8.0100	7.8513	7.9662
			temp	19.6000	0.2138	19.2000	19.8000	19.4213	19.7787
	50	8	do	8.3488	0.2851	7.8400	8.6600	8.1104	8.5871
			ph	8.0725	0.0944	7.9600	8.2300	7.9936	8.1514
			temp	19.5625	0.1506	19.3000	19.8000	19.4366	19.6884

form=SDP

sps	conc	N Obs	Variable	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
BLS	0	8	do	8.7350	0.1707	8.3400	8.9100	8.5923	8.8777
			ph	8.2213	0.1919	8.0200	8.4300	8.0608	8.3817
			temp	19.5000	0.2070	19.2000	19.8000	19.3269	19.6731
	100	8	do	8.5188	0.4025	7.9500	8.8800	8.1822	8.8553
			ph	8.1050	0.1125	7.9900	8.3200	8.0109	8.1991
			temp	19.6125	0.2642	19.3000	19.9000	19.3916	19.8334
	200	8	do	8.1238	0.7208	7.2200	8.8100	7.5212	8.7263
			ph	7.9975	0.0483	7.9500	8.0700	7.9571	8.0379
			temp	19.6875	0.2997	19.3000	20.1000	19.4369	19.9381
	300	8	do	7.7625	1.1958	5.8500	8.8700	6.7628	8.7622
			ph	7.9350	0.0619	7.8400	8.0500	7.8833	7.9867
			temp	19.5250	0.2493	19.2000	19.9000	19.3166	19.7334
	400	8	do	7.9716	1.0039	6.0600	8.7900	7.1323	8.8109
			ph	7.9650	0.1177	7.8500	8.1500	7.8666	8.0634
			temp	19.5625	0.1996	19.3000	19.9000	19.3957	19.7293
	50	8	do	8.7500	0.0845	8.6200	8.8700	8.6793	8.8207
			ph	8.1688	0.1283	8.0400	8.3300	8.0615	8.2760
			temp	19.5625	0.1923	19.3000	19.9000	19.4018	19.7232
FAM	0	8	do	8.6825	0.1332	8.5100	8.9100	8.5712	8.7938
			ph	8.1888	0.1506	7.9800	8.3500	8.0629	8.3146
			temp	19.1000	0.1773	18.7000	19.3000	18.9518	19.2482
	100	8	do	8.4625	0.1367	8.2500	8.6500	8.3482	8.5768
			ph	8.1000	0.0894	7.9800	8.2300	8.0252	8.1748

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			temp	19.1125	0.0835	19.0000	19.2000	19.0427	19.1823
	200	8	do	8.2025	0.5890	6.9400	8.6400	7.7101	8.6949
			ph	8.0125	0.0896	7.9200	8.1700	7.9376	8.0874
			temp	19.0250	0.2550	18.5000	19.3000	18.8119	19.2381
	300	8	do	7.7513	0.9753	6.5200	8.6400	6.9359	8.5666
			ph	7.9138	0.0711	7.8100	8.0300	7.8543	7.9732
			temp	18.9625	0.2669	18.7000	19.4000	18.7393	19.1857
	400	8	do	7.7725	1.0364	6.0200	8.6500	6.9061	8.6389
			ph	7.9350	0.1328	7.8000	8.1200	7.8240	8.0460
			temp	18.9750	0.2121	18.5000	19.2000	18.7977	19.1523
	50	8	do	8.5400	0.1564	8.2400	8.7600	8.4093	8.6707
			ph	8.1413	0.0989	7.9900	8.2800	8.0586	8.2239
			temp	19.1125	0.1458	19.0000	19.4000	18.9906	19.2344
HGE	0	8	do	8.4750	0.0826	8.3600	8.5900	8.4059	8.5441
			ph	8.2863	0.1073	8.1300	8.4000	8.1965	8.3760
			temp	19.8000	0.2976	19.5000	20.1000	19.5512	20.0488
	100	8	do	8.2925	0.2858	7.9000	8.5900	8.0536	8.5314
			ph	8.2138	0.0490	8.1500	8.3000	8.1728	8.2547
			temp	19.8750	0.1669	19.7000	20.1000	19.7355	20.0145
	200	8	do	7.8513	0.7206	6.8400	8.5100	7.2488	8.4537
			ph	8.0388	0.0768	7.9100	8.1100	7.9745	8.1030
			temp	19.9375	0.1506	19.7000	20.2000	19.8116	20.0634
	300	8	do	7.7163	0.9410	6.1300	8.5800	6.9296	8.5029
			ph	7.9913	0.1279	7.8100	8.1300	7.8843	8.0982
			temp	19.9500	0.2507	19.7000	20.4000	19.7404	20.1596
	400	8	do	7.9988	0.6142	7.0800	8.5700	7.4852	8.5123
			ph	8.0463	0.0545	7.9700	8.1400	8.0007	8.0918
			temp	20.0125	0.0991	19.9000	20.2000	19.9296	20.0954
	50	8	do	8.2663	0.2488	7.9000	8.5600	8.0582	8.4743
			ph	8.1800	0.0598	8.1000	8.2800	8.1300	8.2300
			temp	19.9000	0.1852	19.6000	20.1000	19.7452	20.0548
PPB	0	8	do	8.7013	0.1008	8.5400	8.8300	8.6170	8.7855
			ph	8.3388	0.0336	8.2800	8.3800	8.3107	8.3668
			temp	19.8625	0.1506	19.6000	20.1000	19.7366	19.9884
	100	8	do	8.4275	0.4559	7.4500	8.8000	8.0463	8.8087
			ph	8.2463	0.1126	8.0000	8.3400	8.1521	8.3404
			temp	19.6250	0.0886	19.5000	19.7000	19.5509	19.6991
	200	8	do	8.0375	0.7754	6.9900	8.8000	7.3893	8.6857
			ph	8.1438	0.1661	7.9600	8.3100	8.0049	8.2826
			temp	19.7875	0.1959	19.6000	20.2000	19.6237	19.9513
	300	8	do	8.0412	0.7717	6.8500	8.7900	7.3961	8.6864
			ph	8.1600	0.1540	7.9700	8.3400	8.0313	8.2887
			temp	19.7500	0.1604	19.5000	20.0000	19.6159	19.8841
	400	8	do	8.0700	0.8262	6.7000	8.7900	7.3793	8.7607
			ph	8.1600	0.1792	7.8800	8.3700	8.0102	8.3098

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			temp	19.7000	0.1069	19.6000	19.9000	19.6106	19.7894
	50	8	do	8.5788	0.2103	8.2000	8.7900	8.4029	8.7546
			ph	8.3150	0.0521	8.2100	8.3600	8.2714	8.3586
			temp	19.7250	0.1035	19.6000	19.9000	19.6385	19.8115

Performed by K. Weber SAS version 9.4 10:41 07MAY14 KW

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Exposure Termination Period Water Chemistry Means
Only hardness, alkalinity, and conductivity measured

The MEANS Procedure

form=FDP

sps	N Obs	Variable	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
HIC	6	hard	180.2	3.6009	176.0	184.0	176.4	183.9
		alk	147.0	14.8459	128.0	163.0	131.4	162.6
		cond	427.3	35.2004	389.0	470.0	390.4	464.3
MUC	6	hard	178.8	2.7142	176.0	184.0	176.0	181.7
		alk	149.0	14.5327	129.0	166.0	133.7	164.3
		cond	444.3	36.8492	397.0	486.0	405.7	483.0
WAS	6	hard	189.0	1.6733	188.0	192.0	187.2	190.8
		alk	148.2	11.8561	133.0	162.0	135.7	160.6
		cond	429.0	28.6984	396.0	471.0	398.9	459.1

form=SDP

sps	N Obs	Variable	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
BLS	6	hard	183.3	1.0328	182.0	184.0	182.2	184.4
		alk	146.3	13.4114	129.0	161.0	132.3	160.4
		cond	409.3	17.6144	386.0	430.0	390.8	427.8
FAM	6	hard	192.0	6.5727	180.0	198.0	185.1	198.9
		alk	148.3	12.0775	131.0	160.0	135.7	161.0
		cond	429.5	24.4929	395.0	456.0	403.8	455.2
HGE	6	hard	178.3	1.5055	176.0	180.0	176.8	179.9
		alk	140.8	7.9352	130.0	149.0	132.5	149.2
		cond	389.7	18.4463	365.0	410.0	370.3	409.0
PPB	6	hard	180.5	2.3452	178.0	184.0	178.0	183.0
		alk	143.0	10.4499	131.0	157.0	132.0	154.0
		cond	381.8	4.7081	376.0	389.0	376.9	386.8

Performed by K. Weber SAS version 9.4 10:41 07MAY14 KW

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```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels fr
title2 h=2 'Statistical analysis of exposure period water chemistry';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/***********************************************************
* SAS ver 9.4       Analysis prepared by:  KLW KW          *
* Analysis completion date:  07MAY14                        *
***********************************************************/
```

AEH-11-PSEUDO-02

```
/*****************************************************************************************************
* Variable Names:
* sps = three letter code for mussel species
*           BLS = Black sandshell (Ligumia recta)
*           FAM = Fatmucket (Lampsilis siliquoidea)
*           WAS = Washboard (Megalonaias nervosa)
*           HGE = Higgins eye (Lampsilis higginsii)
*           PPB = Plain pocketbook (Lapsilis cardium)
*           HIC = Hickorynut (Obovaria olivaria)
*           MUC = Mucket (Actinonaias ligamentina)
* time = water sampling time
*           0 = Pre-exposure
*           1 = Time 1 during exposure
*           2 = Time 2 during exposure
*           3 = Exposure termination
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
* conc = concentration (in mg/L)
*           0 = control (0 mg/L)
*           50 = 50 mg/L active ingredient
*           100 = 100 mg/L active ingredient
*           200 = 200 mg/L active ingredient
*           300 = 300 mg/L active ingredient
*           400 = 300 mg/L heat deative
* id = exposure chamber ID
*           i.e., 3A5 = test system (1, 2 or 3), Block ID (A or B), and Position in Block (1 - 12)
* do = dissolved oxygen (mg/L)
* temp = temperautre (C)
* pH = pH
* hard = hardness (mg/L CaCO3)
* alk = alkalinity (mg/L CaCO3)
* cond = conductivity (uS/cm2) temperature compensate to 25C
*****************************************************************************************************

data exp_water_chem; set Pseudo02.exp_water_chem;
    disso = do + 0;
        drop do;
        rename disso = do;
    tempy = temp + 0;
        drop temp;
        rename tempy = temp;
    pHval = pH + 0;
        drop pH;
```

FF # 10
Item No. 3
Pg 1 of 2

```
        rename pHval = ph;
    hardy = hard + 0;
        drop hard;
        rename hardy = hard;
    alky = alk + 0;
        drop alk;
        rename alky = alk;
    condy = cond + 0;
        drop cond;
        rename condy = cond;
```

AEH-11-PSEUDO-02

```
proc sort data=exp_water_chem; by form sps time conc id; run;
proc print data=exp_water_chem; run;

data pre_exp; set exp_water_chem;
    If time ne 0 then delete;
    run;

data exp; set exp_water_chem;
    If time <1 then delete;
    If time >2 then delete;
    run;

data post; set exp_water_chem;
    If time ne 3 then delete;
    run;

title1 h=2 'Pre-exposure Period Water Chemistry Means by Species and Formulation';
title2 h=2 'Analyzes dissolved oxygen, temperature, pH, hardness, alkalinity, and conductivity';
proc means data = pre_exp mean std min max clm fw=8;
by form;
class sps;
var do temp ph hard alk cond;
run;

title1 h=2 'Exposure Period Water Chemistry Means by Species and Formulation';
title2 h=2 'Only dissolved oxygen, pH, and temperature measured';
proc means data = exp mean std min max clm fw=8;
by form;
class sps conc;
var do ph temp;
run;

title1 h=2 'Exposure Termination Period Water Chemistry Means';
title2 h=2 'Only hardness, alkalinity, and conductivity measured';
proc means data = post mean std min max clm fw=8;
by form;
class sps;
var hard alk cond;
run;
```

VW 7 MAY 2014

FF # 10
Item No. 3
Pg 2 of 2

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile
mussels from seven different unionid species';
title2 h=2 'Statistical analysis of exposure period water chemistry';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/***********************************************************
* SAS ver 9.4       Analysis prepared by:  KLW             *
* Analysis completion date:  07MAY14                       *
***********************************************************/

/*****************************************************************************************
*************
* Variable Names:
            *
* sps = three letter code for mussel species
            *
*           BLS = Black sandshell (Ligumia recta)
            *
*           FAM = Fatmucket (Lampsilis siliquoidea)
            *
*           WAS = Washboard (Megalonaias nervosa)
            *
*           HGE = Higgins eye (Lampsilis higginsii)
            *
*           PPB = Plain pocketbook (Lapsilis cardium)
            *
*           HIC = Hickorynut (Obovaria olivaria)
            *
*           MUC = Mucket (Actinonaias ligamentina)
            *
* time = water sampling time
            *
*           0 = Pre-exposure
            *
*           1 = Time 1 during exposure
            *
*           2 = Time 2 during exposure
            *
*           3 = Exposure termination
            *
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
            *
* conc = concentration (in mg/L)
            *
*           0 = control (0 mg/L)
            *
*           50 = 50 mg/L active ingredient
            *
*           100 = 100 mg/L active ingredient
            *
```

klw

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FF # 10
Item No. 4
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```
35   *            200 = 200 mg/L active ingredient
35 !              *
36   *            300 = 300 mg/L active ingredient
36 !              *
37   *            400 = 300 mg/L heat deative
37 !              *
38   * id = exposure chamber ID
38 !              *
39   *            i.e., 3A5 = test system (1, 2 or 3), Block ID (A or B), and Position in Block (1
39 !  - 12)       *
40   * do = dissolved oxygen (mg/L)
40 !              *
41   * temp = temperautre (C)
41 !              *
42   * pH = pH
42 !              *
43   * hard = hardness (mg/L CaCO3)
43 !              *
44   * alk = alkalinity (mg/L CaCO3)
44 !              *
45   * cond = conductivity (uS/cm2) temperature compensate to 25C
45 !              *
46   *******************************************************************************************
46 ! ************/
47
48   data exp_water_chem; set Pseudo02.exp_water_chem;
49       disso = do + 0;
50           drop do;
51           rename disso = do;
52       tempy = temp + 0;
53           drop temp;
54           rename tempy = temp;
55       pHval = pH + 0;
56           drop pH;
57           rename pHval = ph;
58       hardy = hard + 0;
59           drop hard;
60           rename hardy = hard;
61       alky = alk + 0;
62           drop alk;
63           rename alky = alk;
64       condy = cond + 0;
65           drop cond;
66           rename condy = cond;
67
68

NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      42 at 49:16    42 at 52:18    42 at 55:16    336 at 58:18   336 at 61:16   336 at 64:18
NOTE: There were 385 observations read from the data set PSEUDO02.EXP_WATER_CHEM.
NOTE: The data set WORK.EXP_WATER_CHEM has 385 observations and 11 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds
```

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```
proc sort data=exp_water_chem; by form sps time conc id; run;

NOTE: There were 385 observations read from the data set WORK.EXP_WATER_CHEM.
NOTE: The data set WORK.EXP_WATER_CHEM has 385 observations and 11 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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```
proc print data=exp_water_chem; run;
NOTE: Writing HTML Body file: sashtml.htm

NOTE: There were 385 observations read from the data set WORK.EXP_WATER_CHEM.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           1.78 seconds
      cpu time            0.60 seconds


data pre_exp; set exp_water_chem;
    If time ne 0 then delete;
    run;

NOTE: There were 385 observations read from the data set WORK.EXP_WATER_CHEM.
NOTE: The data set WORK.PRE_EXP has 7 observations and 11 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


data exp; set exp_water_chem;
    If time <1 then delete;
    If time >2 then delete;
    run;

NOTE: There were 385 observations read from the data set WORK.EXP_WATER_CHEM.
NOTE: The data set WORK.EXP has 336 observations and 11 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


data post; set exp_water_chem;
    If time ne 3 then delete;
    run;

NOTE: There were 385 observations read from the data set WORK.EXP_WATER_CHEM.
NOTE: The data set WORK.POST has 42 observations and 11 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.01 seconds
```

```
title1 h=2 'Pre-exposure Period Water Chemistry Means by Species and Formulation';
title2 h=2 'Analyzes dissolved oxygen, temperature, pH, hardness, alkalinity, and
conductivity';
proc means data = pre_exp mean std min max clm fw=8;
by form;
class sps;
var do temp ph hard alk cond;
run;
```

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```
NOTE: There were 7 observations read from the data set WORK.PRE_EXP.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.06 seconds
      cpu time            0.03 seconds


title1 h=2 'Exposure Period Water Chemistry Means by Species and Formulation';
title2 h=2 'Only dissolved oxygen, pH, and temperature measured';
proc means data = exp mean std min max clm fw=8;
by form;
class sps conc;
var do ph temp;
run;

NOTE: There were 336 observations read from the data set WORK.EXP.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.12 seconds
      cpu time            0.11 seconds


title1 h=2 'Exposure Termination Period Water Chemistry Means';
title2 h=2 'Only hardness, alkalinity, and conductivity measured';
proc means data = post mean std min max clm fw=8;
by form;
class sps;
var hard alk cond;
run;

NOTE: There were 42 observations read from the data set WORK.POST.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.05 seconds
      cpu time            0.03 seconds
```

RW 7Mar2004

FF # 10
Item No. 4
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Study Number: AEH-11-PSEUDO-02	Action	Date	Initials
Data Source: File Folders: 10c, 10c2, 10d, 10h	Created......	1-May-14	KLW KLW
Water Quality Forms: 2, 2a, 3a, LTRMP Reports	Revised......	19-Nov-14	KLW KLW
	Reviewed...	19NOV14	MW
	Certified...		
File Name: I:\AEH-11-PSEUDO-02\Data\[PSEUDO-02 Water Chem for SAS.xlsx]Ammonia			

Total Ammonia Nitrogen

Species, Dosing, and Assessment Information

Scientific Name	Common Name	Abbreviation	Formulation Type	Test Article Lot Number	Exposure Date	Assessment Date
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	12-Jul-11	20-Jul-11
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	14-Jul-11	22-Jul-11
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	13-Dec-11	21-Dec-11
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	27-Jan-12	4-Feb-12
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	17-Apr-12	25-Apr-12
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	16-May-12	24-May-12
Lampsilis higginsii	Higgins eye	HGE	SDP	TR4669-4-(5)	26-May-12	3-Jun-12

Data codes used within SAS

sps = Juvenile mussel species (see 3 letter abbreviation codes above)
time = Sample time
- 0 = Pre-exposure
- 1 = Dosing initiation
- 6 = 6 h post dosing initiation
- 12 = 12 h post dosing initiation
- 24 = 24 h post dosing initiation
- 25 = Weekly from holding period

form = Product formulation
- FDP = Freeze dried powder
- SDP = Spray dried powder

conc = Concentration (mg/L)
- 0 = Control (no product added)
- 50 = 50 mg/L active ingredient
- 100 = 100 mg/L active ingredient
- 200 = 200 mg/L active ingredient
- 300 = 300 mg/L active ingredient
- 400 = 300 mg/L deactive ingredient

id = Exposure chamber ID
- i.e., 1A2 = Test system (1, 2, or 3), Block ID (A or B), and Position in Block (1-12)

temp = Temperature (in ° C)
pH = pH
tan = Total ammonia nitrogen (in mg NH_3-N/L)

Data Explanation

Water chemistry data analyses were limited to simple descriptive statistics (Proc Means) using SAS Version 9.4.

Data Anomalies and Deviations

NONE

File Folder 10
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sps	time	form	conc	id	ph	temp	tan
BLS	0	SDP	.	.	8.32	20.2	0.078
BLS	6	SDP	200	2A1	8.19	20.5	0.138
BLS	6	SDP	300	2A10	8.22	20.0	0.155
BLS	6	SDP	300	2A11	8.22	19.9	0.159
BLS	6	SDP	50	2A12	8.28	20.1	0.062
BLS	6	SDP	400	2A2	8.17	20.1	0.167
BLS	6	SDP	100	2A3	8.20	20.2	0.091
BLS	6	SDP	200	2A4	8.16	20.1	0.115
BLS	6	SDP	100	2A5	8.28	20.0	0.083
BLS	6	SDP	0	2A6	8.29	20.1	0.035
BLS	6	SDP	400	2A7	8.11	20.1	0.159
BLS	6	SDP	0	2A8	8.27	20.1	0.045
BLS	6	SDP	50	2A9	8.29	20.1	0.058
BLS	6	SDP	300	2B1	8.20	20.1	0.161
BLS	6	SDP	400	2B10	8.18	19.4	0.154
BLS	6	SDP	0	2B11	8.29	19.8	0.041
BLS	6	SDP	200	2B12	8.21	20.0	0.107
BLS	6	SDP	100	2B2	8.19	20.0	0.100
BLS	6	SDP	400	2B3	8.21	19.8	0.164
BLS	6	SDP	300	2B4	8.16	19.7	0.164
BLS	6	SDP	50	2B5	8.27	19.8	0.054
BLS	6	SDP	200	2B6	8.14	19.8	0.134
BLS	6	SDP	100	2B7	8.20	19.8	0.076
BLS	6	SDP	50	2B8	8.26	19.6	0.057
BLS	6	SDP	0	2B9	8.28	19.4	0.047
BLS	12	SDP	200	2A1	7.89	18.6	0.080
BLS	12	SDP	300	2A10	8.00	17.5	0.103
BLS	12	SDP	300	2A11	8.06	17.4	0.139
BLS	12	SDP	50	2A12	8.15	17.6	0.057
BLS	12	SDP	400	2A2	7.87	18.4	0.082
BLS	12	SDP	100	2A3	7.94	18.4	0.042
BLS	12	SDP	200	2A4	7.89	18.2	0.044
BLS	12	SDP	100	2A5	8.17	18.1	0.038
BLS	12	SDP	0	2A6	8.30	18.1	0.046
BLS	12	SDP	400	2A7	7.71	17.9	0.076
BLS	12	SDP	0	2A8	8.27	17.7	0.054
BLS	12	SDP	50	2A9	8.13	17.6	0.040
BLS	12	SDP	300	2B1	7.97	17.8	0.119
BLS	12	SDP	400	2B10	7.81	17.7	0.068
BLS	12	SDP	0	2B11	8.30	17.9	0.049
BLS	12	SDP	200	2B12	8.04	18.0	0.059
BLS	12	SDP	100	2B2	8.01	17.9	0.056
BLS	12	SDP	400	2B3	7.89	17.8	0.074
BLS	12	SDP	300	2B4	7.94	17.8	0.114
BLS	12	SDP	50	2B5	8.11	17.9	0.035
BLS	12	SDP	200	2B6	7.87	18.0	0.062

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BLS	12	SDP	100	2B7	7.97	17.9	0.043
BLS	12	SDP	50	2B8	8.14	17.9	0.050
BLS	12	SDP	0	2B9	8.28	17.6	0.042
BLS	24	SDP	200	2A1	8.04	20.1	4.918
BLS	24	SDP	300	2A10	7.97	19.6	4.078
BLS	24	SDP	300	2A11	8.05	19.5	4.967
BLS	24	SDP	50	2A12	8.32	19.6	0.201
BLS	24	SDP	400	2A2	8.13	19.9	5.153
BLS	24	SDP	100	2A3	8.07	19.9	1.292
BLS	24	SDP	200	2A4	7.98	19.9	3.782
BLS	24	SDP	100	2A5	8.32	19.8	1.969
BLS	24	SDP	0	2A6	8.39	19.8	0.064
BLS	24	SDP	400	2A7	7.88	19.7	5.010
BLS	24	SDP	0	2A8	8.43	19.5	0.084
BLS	24	SDP	50	2A9	8.33	19.4	0.175
BLS	24	SDP	300	2B1	7.84	19.9	4.234
BLS	24	SDP	400	2B10	8.00	19.4	4.911
BLS	24	SDP	0	2B11	8.40	19.8	0.058
BLS	24	SDP	200	2B12	8.05	19.9	0.458
BLS	24	SDP	100	2B2	8.20	19.8	3.928
BLS	24	SDP	400	2B3	8.15	19.7	4.871
BLS	24	SDP	300	2B4	7.97	19.8	3.778
BLS	24	SDP	50	2B5	8.25	19.9	0.178
BLS	24	SDP	200	2B6	8.07	19.9	3.381
BLS	24	SDP	100	2B7	8.16	19.9	1.453
BLS	24	SDP	50	2B8	8.24	19.7	0.217
BLS	24	SDP	0	2B9	8.38	19.4	0.060
BLS	25	SDP	.	.	8.31	20.1	0.053
FAM	0	SDP	.	.	7.89	20.8	0.182
FAM	6	SDP	0	1A1	8.30	19.4	0.137
FAM	6	SDP	300	1A10	8.09	19.5	0.719
FAM	6	SDP	100	1A11	8.20	19.5	0.403
FAM	6	SDP	200	1A12	8.15	19.5	0.619
FAM	6	SDP	100	1A2	8.17	19.3	0.242
FAM	6	SDP	50	1A3	8.22	19.3	0.186
FAM	6	SDP	300	1A4	8.12	19.1	0.753
FAM	6	SDP	200	1A5	8.25	18.8	0.582
FAM	6	SDP	400	1A6	8.22	18.8	0.698
FAM	6	SDP	0	1A7	8.30	19.1	0.082
FAM	6	SDP	400	1A8	8.17	19.1	0.665
FAM	6	SDP	50	1A9	8.28	19.3	0.203
FAM	6	SDP	50	1B1	8.19	19.5	0.162
FAM	6	SDP	0	1B10	8.32	19.5	0.077
FAM	6	SDP	100	1B11	8.27	19.4	0.252
FAM	6	SDP	300	1B12	8.20	19.7	0.751
FAM	6	SDP	400	1B2	8.34	19.3	0.698
FAM	6	SDP	100	1B3	8.24	19.4	0.242

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FAM	6	SDP	300	1B4	8.12	19.4	0.774
FAM	6	SDP	0	1B5	8.34	19.4	0.084
FAM	6	SDP	50	1B6	8.26	19.3	0.149
FAM	6	SDP	200	1B7	8.24	19.1	0.566
FAM	6	SDP	400	1B8	8.12	19.3	0.798
FAM	6	SDP	200	1B9	8.15	19.4	0.569
FAM	12	SDP	0	1A1	8.38	19.6	0.068
FAM	12	SDP	300	1A10	7.85	19.8	0.672
FAM	12	SDP	100	1A11	8.04	19.8	0.066
FAM	12	SDP	200	1A12	7.87	19.9	0.419
FAM	12	SDP	100	1A2	8.01	19.6	0.052
FAM	12	SDP	50	1A3	8.11	19.5	0.064
FAM	12	SDP	300	1A4	7.85	19.4	0.735
FAM	12	SDP	200	1A5	8.13	19.1	0.406
FAM	12	SDP	400	1A6	8.05	19.0	0.661
FAM	12	SDP	0	1A7	8.38	19.4	0.049
FAM	12	SDP	400	1A8	7.87	19.6	0.677
FAM	12	SDP	50	1A9	8.27	19.6	0.135
FAM	12	SDP	50	1B1	8.12	19.9	0.098
FAM	12	SDP	0	1B10	8.35	19.8	0.089
FAM	12	SDP	100	1B11	8.18	19.7	0.165
FAM	12	SDP	300	1B12	7.97	20.0	0.880
FAM	12	SDP	400	1B2	7.83	19.7	0.813
FAM	12	SDP	100	1B3	8.05	19.8	0.059
FAM	12	SDP	300	1B4	7.81	19.8	0.828
FAM	12	SDP	0	1B5	8.38	19.8	0.060
FAM	12	SDP	50	1B6	8.20	19.7	0.058
FAM	12	SDP	200	1B7	8.02	19.5	0.217
FAM	12	SDP	400	1B8	7.73	19.7	1.025
FAM	12	SDP	200	1B9	7.81	19.8	0.567
FAM	24	SDP	0	1A1	8.27	19.1	0.063
FAM	24	SDP	300	1A10	7.82	19.2	4.034
FAM	24	SDP	100	1A11	8.19	19.2	1.618
FAM	24	SDP	200	1A12	8.13	19.3	3.360
FAM	24	SDP	100	1A2	8.14	19.0	1.352
FAM	24	SDP	50	1A3	8.18	19.0	0.750
FAM	24	SDP	300	1A4	7.81	18.7	3.348
FAM	24	SDP	200	1A5	8.17	18.5	3.170
FAM	24	SDP	400	1A6	8.12	18.5	3.664
FAM	24	SDP	0	1A7	8.31	18.7	0.050
FAM	24	SDP	400	1A8	7.81	19.0	5.135
FAM	24	SDP	50	1A9	8.28	19.0	0.504
FAM	24	SDP	50	1B1	8.15	19.4	0.749
FAM	24	SDP	0	1B10	8.33	19.3	0.103
FAM	24	SDP	100	1B11	8.23	19.2	1.400
FAM	24	SDP	300	1B12	8.03	19.4	5.037
FAM	24	SDP	400	1B2	8.08	19.2	3.759

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FAM	24	SDP	100	1B3	8.14	19.2	1.509
FAM	24	SDP	300	1B4	7.92	19.2	4.510
FAM	24	SDP	0	1B5	8.35	19.2	0.088
FAM	24	SDP	50	1B6	8.25	19.2	0.866
FAM	24	SDP	200	1B7	7.99	19.0	2.569
FAM	24	SDP	400	1B8	7.83	19.1	4.041
FAM	24	SDP	200	1B9	7.95	19.3	3.520
FAM	25	SDP	.	.	8.03	20.5	0.094
HGE	0	SDP	.	.	8.22	20.5	0.056
HGE	6	SDP	0	1A1	8.33	20.0	0.019
HGE	6	SDP	50	1A10	8.28	20.0	0.068
HGE	6	SDP	200	1A11	8.23	20.1	0.167
HGE	6	SDP	300	1A12	8.26	20.1	0.188
HGE	6	SDP	300	1A2	8.27	19.9	0.226
HGE	6	SDP	100	1A3	8.29	19.9	0.111
HGE	6	SDP	200	1A4	8.24	20.0	0.154
HGE	6	SDP	400	1A5	8.21	19.8	0.235
HGE	6	SDP	50	1A6	8.29	19.8	0.073
HGE	6	SDP	400	1A7	8.22	19.9	0.205
HGE	6	SDP	0	1A8	8.38	19.8	0.028
HGE	6	SDP	100	1A9	8.25	19.9	0.056
HGE	6	SDP	0	1B1	8.37	19.7	0.022
HGE	6	SDP	50	1B10	8.20	20.0	0.170
HGE	6	SDP	400	1B11	8.19	20.1	0.175
HGE	6	SDP	300	1B12	8.17	20.3	0.255
HGE	6	SDP	200	1B2	8.23	19.9	0.151
HGE	6	SDP	100	1B3	8.29	19.8	0.096
HGE	6	SDP	50	1B4	8.25	19.8	0.032
HGE	6	SDP	200	1B5	8.25	19.9	0.170
HGE	6	SDP	300	1B6	8.25	19.9	0.189
HGE	6	SDP	400	1B7	8.15	19.8	0.216
HGE	6	SDP	0	1B8	8.37	19.8	0.032
HGE	6	SDP	100	1B9	8.32	19.9	0.099
HGE	12	SDP	0	1A1	8.36	20.1	0.031
HGE	12	SDP	50	1A10	8.08	20.2	0.065
HGE	12	SDP	200	1A11	7.85	20.2	0.159
HGE	12	SDP	300	1A12	8.01	20.3	0.158
HGE	12	SDP	300	1A2	7.98	20.1	0.282
HGE	12	SDP	100	1A3	8.04	20.1	0.065
HGE	12	SDP	200	1A4	7.96	20.1	0.086
HGE	12	SDP	400	1A5	7.88	19.9	0.347
HGE	12	SDP	50	1A6	8.07	20.0	0.050
HGE	12	SDP	400	1A7	7.94	20.0	0.186
HGE	12	SDP	0	1A8	8.40	20.1	0.017
HGE	12	SDP	100	1A9	7.95	20.2	0.066
HGE	12	SDP	0	1B1	8.40	20.1	0.013
HGE	12	SDP	50	1B10	7.87	20.2	0.027

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HGE	12	SDP	400	1B11	7.76	20.3	0.087
HGE	12	SDP	300	1B12	7.71	20.5	0.439
HGE	12	SDP	200	1B2	7.83	20.0	0.129
HGE	12	SDP	100	1B3	8.00	20.1	0.161
HGE	12	SDP	50	1B4	8.12	20.1	0.099
HGE	12	SDP	200	1B5	7.82	20.1	0.389
HGE	12	SDP	300	1B6	8.03	20.1	0.178
HGE	12	SDP	400	1B7	7.73	20.1	0.492
HGE	12	SDP	0	1B8	8.40	20.0	0.024
HGE	12	SDP	100	1B9	8.07	20.1	0.207
HGE	24	SDP	0	1A1	8.36	20.1	0.056
HGE	24	SDP	50	1A10	8.25	20.1	0.290
HGE	24	SDP	200	1A11	7.91	20.2	2.247
HGE	24	SDP	300	1A12	8.05	20.2	3.462
HGE	24	SDP	300	1A2	7.83	20.0	2.739
HGE	24	SDP	100	1A3	8.26	20.0	1.590
HGE	24	SDP	200	1A4	8.06	20.0	1.882
HGE	24	SDP	400	1A5	8.06	20.0	3.955
HGE	24	SDP	50	1A6	8.28	20.0	0.272
HGE	24	SDP	400	1A7	8.14	20.0	2.901
HGE	24	SDP	0	1A8	8.39	20.1	0.062
HGE	24	SDP	100	1A9	8.21	20.1	0.411
HGE	24	SDP	0	1B1	8.38	20.1	0.056
HGE	24	SDP	50	1B10	8.19	20.1	0.203
HGE	24	SDP	400	1B11	7.98	20.2	3.631
HGE	24	SDP	300	1B12	7.81	20.4	2.283
HGE	24	SDP	200	1B2	7.93	20.0	1.826
HGE	24	SDP	100	1B3	8.22	20.0	1.449
HGE	24	SDP	50	1B4	8.10	20.0	0.064
HGE	24	SDP	200	1B5	8.04	20.0	2.925
HGE	24	SDP	300	1B6	7.89	20.0	1.516
HGE	24	SDP	400	1B7	7.97	20.0	3.613
HGE	24	SDP	0	1B8	8.40	20.0	0.058
HGE	24	SDP	100	1B9	8.30	20.0	1.418
HGE	25	SDP	.	.	8.28	20.2	0.057
HIC	0	FDP	.	.	8.35	20.9	0.040
HIC	1	FDP	0	.	8.18	20.1	0.022
HIC	1	FDP	50	.	8.11	20.2	0.033
HIC	1	FDP	100	.	8.06	20.3	0.045
HIC	1	FDP	200	.	7.99	20.3	0.069
HIC	1	FDP	300	.	7.91	20.3	0.104
HIC	1	FDP	400	.	7.91	20.3	0.096
HIC	6	FDP	200	1A1	8.33	19.0	0.109
HIC	6	FDP	400	1A10	8.30	19.2	0.094
HIC	6	FDP	200	1A11	8.35	19.2	0.084
HIC	6	FDP	300	1A12	8.23	19.3	0.154
HIC	6	FDP	0	1A2	8.39	19.0	0.013

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HIC	6	FDP	300	1A3	8.30	19.0	0.140
HIC	6	FDP	50	1A4	8.35	19.0	0.063
HIC	6	FDP	0	1A5	8.40	19.0	0.015
HIC	6	FDP	100	1A6	8.35	19.0	0.054
HIC	6	FDP	50	1A7	8.35	19.1	0.031
HIC	6	FDP	400	1A8	8.31	19.2	0.088
HIC	6	FDP	100	1A9	8.34	19.2	0.062
HIC	6	FDP	300	1B1	8.27	19.0	0.139
HIC	6	FDP	100	1B10	8.34	19.0	0.054
HIC	6	FDP	50	1B11	8.36	19.1	0.034
HIC	6	FDP	0	1B12	8.38	19.3	0.021
HIC	6	FDP	0	1B2	8.40	19.0	0.016
HIC	6	FDP	100	1B3	8.30	19.0	0.036
HIC	6	FDP	300	1B4	8.27	19.0	0.305
HIC	6	FDP	200	1B5	8.34	19.0	0.093
HIC	6	FDP	400	1B6	8.29	19.1	0.082
HIC	6	FDP	400	1B7	8.30	19.1	0.083
HIC	6	FDP	200	1B8	8.32	19.2	0.098
HIC	6	FDP	50	1B9	8.36	19.1	0.039
HIC	12	FDP	200	1A1	8.11	18.3	0.508
HIC	12	FDP	400	1A10	8.03	18.8	0.068
HIC	12	FDP	200	1A11	8.15	18.7	0.151
HIC	12	FDP	300	1A12	7.88	18.7	0.466
HIC	12	FDP	0	1A2	8.26	18.3	0.017
HIC	12	FDP	300	1A3	7.98	18.3	0.324
HIC	12	FDP	50	1A4	8.21	18.3	0.206
HIC	12	FDP	0	1A5	8.34	18.3	0.012
HIC	12	FDP	100	1A6	8.15	18.3	0.068
HIC	12	FDP	50	1A7	8.17	18.5	0.131
HIC	12	FDP	400	1A8	7.95	18.6	0.117
HIC	12	FDP	100	1A9	8.09	18.6	0.129
HIC	12	FDP	300	1B1	7.95	18.4	0.325
HIC	12	FDP	100	1B10	8.10	18.4	0.071
HIC	12	FDP	50	1B11	8.21	18.5	0.076
HIC	12	FDP	0	1B12	8.34	18.7	0.033
HIC	12	FDP	0	1B2	8.36	18.2	0.022
HIC	12	FDP	100	1B3	8.08	18.3	0.022
HIC	12	FDP	300	1B4	7.93	18.3	0.353
HIC	12	FDP	200	1B5	8.12	18.3	0.066
HIC	12	FDP	400	1B6	7.81	18.4	0.064
HIC	12	FDP	400	1B7	7.90	18.4	0.064
HIC	12	FDP	200	1B8	8.12	18.4	0.008
HIC	12	FDP	50	1B9	8.18	18.4	0.079
HIC	24	FDP	200	1A1	8.21	18.3	8.313
HIC	24	FDP	400	1A10	8.00	18.5	11.630
HIC	24	FDP	200	1A11	8.17	18.5	8.181
HIC	24	FDP	300	1A12	8.03	18.7	11.500

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HIC	24	FDP	0	1A2	8.30	18.3	0.017
HIC	24	FDP	300	1A3	8.04	18.2	11.244
HIC	24	FDP	50	1A4	8.26	18.2	1.210
HIC	24	FDP	0	1A5	8.33	18.2	0.012
HIC	24	FDP	100	1A6	8.17	18.3	3.657
HIC	24	FDP	50	1A7	8.22	18.5	1.174
HIC	24	FDP	400	1A8	8.00	18.6	11.780
HIC	24	FDP	100	1A9	8.17	18.5	3.714
HIC	24	FDP	300	1B1	7.99	18.2	9.028
HIC	24	FDP	100	1B10	8.16	18.5	3.130
HIC	24	FDP	50	1B11	8.27	18.6	1.352
HIC	24	FDP	0	1B12	8.33	18.7	0.010
HIC	24	FDP	0	1B2	8.35	18.2	0.022
HIC	24	FDP	100	1B3	8.06	18.3	3.511
HIC	24	FDP	300	1B4	7.95	18.3	10.235
HIC	24	FDP	200	1B5	8.08	18.3	6.744
HIC	24	FDP	400	1B6	8.02	18.3	11.906
HIC	24	FDP	400	1B7	7.97	18.3	11.304
HIC	24	FDP	200	1B8	8.14	18.4	7.968
HIC	24	FDP	50	1B9	8.24	18.5	1.302
HIC	25	FDP	.	.	8.29	19.3	0.100
MUC	0	FDP	.	.	8.28	19.6	0.080
MUC	1	FDP	0	.	8.09	20.2	0.011
MUC	1	FDP	50	.	8.04	20.1	0.022
MUC	1	FDP	100	.	8.01	19.9	0.033
MUC	1	FDP	200	.	7.94	19.8	0.057
MUC	1	FDP	300	.	7.89	19.9	0.083
MUC	1	FDP	400	.	7.78	19.9	0.080
MUC	6	FDP	200	2A1	8.25	19.1	0.106
MUC	6	FDP	50	2A10	8.31	18.3	0.058
MUC	6	FDP	0	2A11	8.32	18.3	0.021
MUC	6	FDP	400	2A12	8.23	18.3	0.100
MUC	6	FDP	300	2A2	8.27	18.8	0.151
MUC	6	FDP	50	2A3	8.33	18.8	0.042
MUC	6	FDP	0	2A4	8.30	18.8	0.018
MUC	6	FDP	200	2A5	8.30	18.7	0.110
MUC	6	FDP	100	2A6	8.16	18.6	0.225
MUC	6	FDP	100	2A7	8.34	18.6	0.061
MUC	6	FDP	400	2A8	8.20	18.6	0.105
MUC	6	FDP	300	2A9	8.26	18.4	0.187
MUC	6	FDP	400	2B1	8.26	18.4	0.087
MUC	6	FDP	0	2B10	8.36	18.2	0.018
MUC	6	FDP	200	2B11	8.28	18.3	0.109
MUC	6	FDP	200	2B12	8.24	18.5	0.103
MUC	6	FDP	300	2B2	8.29	18.3	0.138
MUC	6	FDP	100	2B3	8.36	18.3	0.075
MUC	6	FDP	300	2B4	8.26	18.4	0.150

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MUC	6	FDP	50	2B5	8.31	18.5	0.080
MUC	6	FDP	400	2B6	8.27	18.4	0.093
MUC	6	FDP	0	2B7	8.35	18.4	0.017
MUC	6	FDP	100	2B8	8.30	18.3	0.061
MUC	6	FDP	50	2B9	8.32	18.2	0.043
MUC	12	FDP	200	2A1	8.00	18.8	0.435
MUC	12	FDP	50	2A10	8.15	18.2	0.162
MUC	12	FDP	0	2A11	8.36	18.1	0.051
MUC	12	FDP	400	2A12	7.92	18.1	0.209
MUC	12	FDP	300	2A2	8.12	18.7	0.531
MUC	12	FDP	50	2A3	8.23	18.7	0.150
MUC	12	FDP	0	2A4	8.35	18.7	0.017
MUC	12	FDP	200	2A5	8.16	18.6	0.285
MUC	12	FDP	100	2A6	7.92	18.6	1.567
MUC	12	FDP	100	2A7	8.24	18.4	0.141
MUC	12	FDP	400	2A8	7.95	18.3	0.152
MUC	12	FDP	300	2A9	8.06	18.3	0.375
MUC	12	FDP	400	2B1	7.98	18.2	0.124
MUC	12	FDP	0	2B10	8.37	18.0	0.022
MUC	12	FDP	200	2B11	8.13	18.3	0.370
MUC	12	FDP	200	2B12	8.03	18.5	0.342
MUC	12	FDP	300	2B2	8.13	18.2	0.600
MUC	12	FDP	100	2B3	8.28	18.3	0.162
MUC	12	FDP	300	2B4	8.05	18.3	0.473
MUC	12	FDP	50	2B5	8.22	18.3	0.124
MUC	12	FDP	400	2B6	8.00	18.3	0.128
MUC	12	FDP	0	2B7	8.38	18.2	0.019
MUC	12	FDP	100	2B8	8.21	18.2	0.264
MUC	12	FDP	50	2B9	8.24	18.1	0.132
MUC	24	FDP	200	2A1	8.23	18.9	8.800
MUC	24	FDP	50	2A10	8.18	18.3	1.266
MUC	24	FDP	0	2A11	8.30	18.3	0.013
MUC	24	FDP	400	2A12	7.96	18.3	11.237
MUC	24	FDP	300	2A2	8.12	18.8	12.373
MUC	24	FDP	50	2A3	8.26	18.8	1.495
MUC	24	FDP	0	2A4	8.12	18.8	0.012
MUC	24	FDP	200	2A5	8.13	18.7	10.165
MUC	24	FDP	100	2A6	8.21	18.7	4.212
MUC	24	FDP	100	2A7	8.26	18.6	4.133
MUC	24	FDP	400	2A8	8.00	18.4	10.208
MUC	24	FDP	300	2A9	8.07	18.5	9.696
MUC	24	FDP	400	2B1	7.98	18.5	10.533
MUC	24	FDP	0	2B10	8.35	18.2	0.011
MUC	24	FDP	200	2B11	8.13	18.4	7.168
MUC	24	FDP	200	2B12	8.13	18.6	7.083
MUC	24	FDP	300	2B2	8.10	18.4	12.130
MUC	24	FDP	100	2B3	8.30	18.4	2.477

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MUC	24	FDP	300	2B4	7.98	18.5	11.610
MUC	24	FDP	50	2B5	8.22	18.5	1.271
MUC	24	FDP	400	2B6	8.01	18.3	10.703
MUC	24	FDP	0	2B7	8.32	18.3	0.012
MUC	24	FDP	100	2B8	8.27	18.3	3.999
MUC	24	FDP	50	2B9	8.25	18.2	1.395
MUC	25	FDP	.	.	8.31	19.3	0.060
PPB	0	SDP	.	.	8.07	20.7	0.108
PPB	6	SDP	0	1A1	8.38	20.1	0.086
PPB	6	SDP	50	1A10	8.38	19.8	0.089
PPB	6	SDP	200	1A11	8.33	19.8	0.159
PPB	6	SDP	300	1A12	8.30	20.0	0.147
PPB	6	SDP	400	1A2	8.38	19.6	0.153
PPB	6	SDP	0	1A3	8.45	19.8	0.093
PPB	6	SDP	400	1A4	8.31	19.8	0.173
PPB	6	SDP	200	1A5	8.34	19.5	0.160
PPB	6	SDP	100	1A6	8.36	19.6	0.134
PPB	6	SDP	100	1A7	8.33	19.7	0.133
PPB	6	SDP	50	1A8	8.38	19.7	0.115
PPB	6	SDP	300	1A9	8.40	19.6	0.200
PPB	6	SDP	400	1B1	8.25	19.8	0.116
PPB	6	SDP	0	1B10	8.37	19.9	0.097
PPB	6	SDP	300	1B11	8.31	19.8	0.176
PPB	6	SDP	200	1B12	8.25	20.0	0.104
PPB	6	SDP	300	1B2	8.30	19.6	0.197
PPB	6	SDP	50	1B3	8.34	19.8	0.088
PPB	6	SDP	400	1B4	8.30	19.7	0.161
PPB	6	SDP	100	1B5	8.31	19.8	0.107
PPB	6	SDP	200	1B6	8.30	19.6	0.145
PPB	6	SDP	100	1B7	8.33	19.7	0.116
PPB	6	SDP	50	1B8	8.33	19.7	0.101
PPB	6	SDP	0	1B9	8.41	19.7	0.107
PPB	12	SDP	0	1A1	8.33	20.1	0.104
PPB	12	SDP	50	1A10	8.19	19.8	0.096
PPB	12	SDP	200	1A11	8.08	19.9	0.111
PPB	12	SDP	300	1A12	8.04	20.1	0.120
PPB	12	SDP	400	1A2	8.23	19.4	0.123
PPB	12	SDP	0	1A3	8.42	19.7	0.117
PPB	12	SDP	400	1A4	7.94	19.8	0.159
PPB	12	SDP	200	1A5	8.06	19.6	0.102
PPB	12	SDP	100	1A6	8.14	19.5	0.122
PPB	12	SDP	100	1A7	8.05	19.6	0.102
PPB	12	SDP	50	1A8	8.15	19.6	0.092
PPB	12	SDP	300	1A9	8.14	19.6	0.111
PPB	12	SDP	400	1B1	8.07	19.8	0.087
PPB	12	SDP	0	1B10	8.42	19.8	0.093
PPB	12	SDP	300	1B11	8.12	19.8	0.093

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PPB	12	SDP	200	1B12	8.02	20.0	0.085
PPB	12	SDP	300	1B2	8.04	19.7	0.107
PPB	12	SDP	50	1B3	8.08	19.7	0.090
PPB	12	SDP	400	1B4	7.99	19.8	0.115
PPB	12	SDP	100	1B5	8.09	19.7	0.087
PPB	12	SDP	200	1B6	8.02	19.6	0.104
PPB	12	SDP	100	1B7	8.14	19.6	0.098
PPB	12	SDP	50	1B8	8.17	19.7	0.090
PPB	12	SDP	0	1B9	8.43	19.7	0.105
PPB	24	SDP	0	1A1	8.28	20.0	0.089
PPB	24	SDP	50	1A10	8.21	19.9	0.188
PPB	24	SDP	200	1A11	8.01	19.9	0.438
PPB	24	SDP	300	1A12	8.13	20.0	0.493
PPB	24	SDP	400	1A2	8.19	19.9	2.118
PPB	24	SDP	0	1A3	8.35	19.9	0.118
PPB	24	SDP	400	1A4	7.88	19.8	0.498
PPB	24	SDP	200	1A5	7.96	19.7	0.418
PPB	24	SDP	100	1A6	8.00	19.6	0.412
PPB	24	SDP	100	1A7	8.25	19.6	0.492
PPB	24	SDP	50	1A8	8.31	19.8	0.233
PPB	24	SDP	300	1A9	7.98	19.8	0.514
PPB	24	SDP	400	1B1	8.00	19.7	0.411
PPB	24	SDP	0	1B10	8.32	19.9	0.068
PPB	24	SDP	300	1B11	8.02	19.9	2.194
PPB	24	SDP	200	1B12	7.96	20.2	1.305
PPB	24	SDP	300	1B2	7.97	19.7	2.016
PPB	24	SDP	50	1B3	8.29	19.7	0.329
PPB	24	SDP	400	1B4	7.99	19.7	2.114
PPB	24	SDP	100	1B5	8.20	19.7	0.572
PPB	24	SDP	200	1B6	8.03	19.7	2.059
PPB	24	SDP	100	1B7	8.22	19.7	1.176
PPB	24	SDP	50	1B8	8.29	19.8	0.401
PPB	24	SDP	0	1B9	8.34	19.8	0.054
PPB	25	SDP	.	.	8.09	20.2	0.052
WAS	0	FDP	.	.	8.18	20.3	0.089
WAS	6	FDP	50	2A1	8.06	20.8	0.127
WAS	6	FDP	200	2A10	7.95	20.5	0.232
WAS	6	FDP	0	2A11	8.22	20.6	0.070
WAS	6	FDP	50	2A12	8.08	20.8	0.151
WAS	6	FDP	100	2A2	8.04	20.6	0.293
WAS	6	FDP	100	2A3	8.00	20.5	0.127
WAS	6	FDP	300	2A4	8.03	20.6	0.302
WAS	6	FDP	400	2A5	8.08	20.6	0.264
WAS	6	FDP	200	2A6	8.06	20.7	0.329
WAS	6	FDP	400	2A7	8.07	20.6	0.251
WAS	6	FDP	300	2A8	7.97	20.5	0.374
WAS	6	FDP	0	2A9	8.26	20.4	0.065

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WAS	6	FDP	0	2B1	8.21	20.8	0.080
WAS	6	FDP	200	2B10	8.13	20.2	0.286
WAS	6	FDP	50	2B11	8.22	20.4	0.171
WAS	6	FDP	100	2B12	8.18	20.6	0.255
WAS	6	FDP	50	2B2	8.21	20.7	0.194
WAS	6	FDP	200	2B3	8.12	20.7	0.263
WAS	6	FDP	300	2B4	8.08	20.6	0.339
WAS	6	FDP	400	2B5	8.26	19.6	0.247
WAS	6	FDP	300	2B6	8.05	20.5	0.338
WAS	6	FDP	0	2B7	8.23	20.4	0.082
WAS	6	FDP	400	2B8	8.10	20.4	0.232
WAS	6	FDP	100	2B9	8.13	20.4	0.188
WAS	12	FDP	50	2A1	8.02	20.1	0.320
WAS	12	FDP	200	2A10	7.83	19.9	1.704
WAS	12	FDP	0	2A11	8.23	19.9	0.071
WAS	12	FDP	50	2A12	8.04	20.1	0.234
WAS	12	FDP	100	2A2	7.97	19.9	0.563
WAS	12	FDP	100	2A3	7.97	19.7	0.430
WAS	12	FDP	300	2A4	7.91	19.8	1.389
WAS	12	FDP	400	2A5	7.84	19.9	1.547
WAS	12	FDP	200	2A6	7.97	19.8	0.576
WAS	12	FDP	400	2A7	7.80	19.7	1.925
WAS	12	FDP	300	2A8	7.83	19.6	1.848
WAS	12	FDP	0	2A9	8.25	19.8	0.079
WAS	12	FDP	0	2B1	8.33	20.3	0.076
WAS	12	FDP	200	2B10	8.11	19.5	1.527
WAS	12	FDP	50	2B11	8.25	19.7	0.389
WAS	12	FDP	100	2B12	8.22	20.0	1.200
WAS	12	FDP	50	2B2	8.20	20.1	0.444
WAS	12	FDP	200	2B3	8.10	20.2	0.979
WAS	12	FDP	300	2B4	8.02	19.9	1.169
WAS	12	FDP	400	2B5	8.25	18.7	1.073
WAS	12	FDP	300	2B6	7.95	19.9	1.207
WAS	12	FDP	0	2B7	8.33	20.0	0.095
WAS	12	FDP	400	2B8	7.95	19.8	1.391
WAS	12	FDP	100	2B9	8.04	19.6	0.403
WAS	24	FDP	50	2A1	8.03	19.8	0.993
WAS	24	FDP	200	2A10	7.93	19.2	5.119
WAS	24	FDP	0	2A11	8.24	19.2	0.034
WAS	24	FDP	50	2A12	8.04	19.3	0.980
WAS	24	FDP	100	2A2	8.02	19.6	2.641
WAS	24	FDP	100	2A3	8.00	19.4	2.308
WAS	24	FDP	300	2A4	7.85	19.4	8.460
WAS	24	FDP	400	2A5	7.91	19.4	7.693
WAS	24	FDP	200	2A6	7.93	19.4	4.288
WAS	24	FDP	400	2A7	7.82	19.2	9.719
WAS	24	FDP	300	2A8	7.91	19.0	7.269

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WAS	24	FDP	0	2A9	8.27	19.2	0.037	
WAS	24	FDP	0	2B1	8.27	19.9	0.053	
WAS	24	FDP	200	2B10	8.08	19.4	5.424	
WAS	24	FDP	50	2B11	8.23	19.6	1.670	
WAS	24	FDP	100	2B12	8.20	19.7	2.744	
WAS	24	FDP	50	2B2	8.18	19.6	1.631	
WAS	24	FDP	200	2B3	7.98	19.7	6.741	
WAS	24	FDP	300	2B4	7.91	19.7	5.593	
WAS	24	FDP	400	2B5	7.97	19.7	5.435	AEH-11-PSEUDO-02
WAS	24	FDP	300	2B6	7.86	19.8	5.928	
WAS	24	FDP	0	2B7	8.26	19.8	0.015	
WAS	24	FDP	400	2B8	8.01	19.7	5.527	
WAS	24	FDP	100	2B9	8.06	19.6	2.535	
WAS	25	FDP	.	.	7.99	20.9	0.025	

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Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical analysis of ammonia levels (TAN and un-ionized)
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW KW

Obs	sps	time	form	conc	id	ph	temp	tan	un_ion
1	BLS	0	SDP	.	.	8.32	20.20	0.0780	0.00606
2	BLS	6	SDP	0	2A6	8.29	20.10	0.0350	0.00253
3	BLS	6	SDP	0	2A8	8.27	20.10	0.0450	0.00312
4	BLS	6	SDP	0	2B11	8.29	19.80	0.0410	0.00291
5	BLS	6	SDP	0	2B9	8.28	19.40	0.0470	0.00317
6	BLS	6	SDP	50	2A12	8.28	20.10	0.0620	0.00439
7	BLS	6	SDP	50	2A9	8.29	20.10	0.0580	0.00420
8	BLS	6	SDP	50	2B5	8.27	19.80	0.0540	0.00367
9	BLS	6	SDP	50	2B8	8.26	19.60	0.0570	0.00374
10	BLS	6	SDP	100	2A3	8.20	20.20	0.0910	0.00546
11	BLS	6	SDP	100	2A5	8.28	20.00	0.0830	0.00584
12	BLS	6	SDP	100	2B2	8.19	20.00	0.1000	0.00580
13	BLS	6	SDP	100	2B7	8.20	19.80	0.0760	0.00444
14	BLS	6	SDP	200	2A1	8.19	20.50	0.1380	0.00828
15	BLS	6	SDP	200	2A4	8.16	20.10	0.1150	0.00629
16	BLS	6	SDP	200	2B12	8.21	20.00	0.1070	0.00648
17	BLS	6	SDP	200	2B6	8.14	19.80	0.1340	0.00687
18	BLS	6	SDP	300	2A10	8.22	20.00	0.1550	0.00959
19	BLS	6	SDP	300	2A11	8.22	19.90	0.1590	0.00977
20	BLS	6	SDP	300	2B1	8.20	20.10	0.1610	0.00960
21	BLS	6	SDP	300	2B4	8.16	19.70	0.1640	0.00872
22	BLS	6	SDP	400	2A2	8.17	20.10	0.1670	0.00933
23	BLS	6	SDP	400	2A7	8.11	20.10	0.1590	0.00779
24	BLS	6	SDP	400	2B10	8.18	19.40	0.1540	0.00838
25	BLS	6	SDP	400	2B3	8.21	19.80	0.1640	0.00979
26	BLS	12	SDP	0	2A6	8.30	18.10	0.0460	0.00297
27	BLS	12	SDP	0	2A8	8.27	17.70	0.0540	0.00317
28	BLS	12	SDP	0	2B11	8.30	17.90	0.0490	0.00312
29	BLS	12	SDP	0	2B9	8.28	17.60	0.0420	0.00250
30	BLS	12	SDP	50	2A12	8.15	17.60	0.0570	0.00256

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31	BLS	12	SDP	50	2A9	8.13	17.60	0.0400	0.00172
32	BLS	12	SDP	50	2B5	8.11	17.90	0.0350	0.00147
33	BLS	12	SDP	50	2B8	8.14	17.90	0.0500	0.00224
34	BLS	12	SDP	100	2A3	7.94	18.40	0.0420	0.00125
35	BLS	12	SDP	100	2A5	8.17	18.10	0.0380	0.00185
36	BLS	12	SDP	100	2B2	8.01	17.90	0.0560	0.00188
37	BLS	12	SDP	100	2B7	7.97	17.90	0.0430	0.00132
38	BLS	12	SDP	200	2A1	7.89	18.60	0.0800	0.00217
39	BLS	12	SDP	200	2A4	7.89	18.20	0.0440	0.00116
40	BLS	12	SDP	200	2B12	8.04	18.00	0.0590	0.00214
41	BLS	12	SDP	200	2B6	7.87	18.00	0.0620	0.00154
42	BLS	12	SDP	300	2A10	8.00	17.50	0.1030	0.00329
43	BLS	12	SDP	300	2A11	8.06	17.40	0.1390	0.00504
44	BLS	12	SDP	300	2B1	7.97	17.80	0.1190	0.00364
45	BLS	12	SDP	300	2B4	7.94	17.80	0.1140	0.00326
46	BLS	12	SDP	400	2A2	7.87	18.40	0.0820	0.00209
47	BLS	12	SDP	400	2A7	7.71	17.90	0.0760	0.00130
48	BLS	12	SDP	400	2B10	7.81	17.70	0.0680	0.00144
49	BLS	12	SDP	400	2B3	7.89	17.80	0.0740	0.00189
50	BLS	24	SDP	0	2A6	8.39	19.80	0.0640	0.00561
51	BLS	24	SDP	0	2A8	8.43	19.50	0.0840	0.00785
52	BLS	24	SDP	0	2B11	8.40	19.80	0.0580	0.00519
53	BLS	24	SDP	0	2B9	8.38	19.40	0.0600	0.00501
54	BLS	24	SDP	50	2A12	8.32	19.60	0.2010	0.01499
55	BLS	24	SDP	50	2A9	8.33	19.40	0.1750	0.01315
56	BLS	24	SDP	50	2B5	8.25	19.90	0.1780	0.01166
57	BLS	24	SDP	50	2B8	8.24	19.70	0.2170	0.01373
58	BLS	24	SDP	100	2A3	8.07	19.90	1.2920	0.05721
59	BLS	24	SDP	100	2A5	8.32	19.80	1.9690	0.14886
60	BLS	24	SDP	100	2B2	8.20	19.80	3.9280	0.22947
61	BLS	24	SDP	100	2B7	8.16	19.90	1.4530	0.07835
62	BLS	24	SDP	200	2A1	8.04	20.10	4.9180	0.20671
63	BLS	24	SDP	200	2A4	7.98	19.90	3.7820	0.13726
64	BLS	24	SDP	200	2B12	8.05	19.90	0.4580	0.01941
65	BLS	24	SDP	200	2B6	8.07	19.90	3.3810	0.14971

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	BLS	24	SDP	300	2A10	7.97	19.60	4.0780	0.14171
67	BLS	24	SDP	300	2A11	8.05	19.50	4.9670	0.20463
68	BLS	24	SDP	300	2B1	7.84	19.90	4.2340	0.11244
69	BLS	24	SDP	300	2B4	7.97	19.80	3.7780	0.13316
70	BLS	24	SDP	400	2A2	8.13	19.90	5.1530	0.26027
71	BLS	24	SDP	400	2A7	7.88	19.70	5.0100	0.14346
72	BLS	24	SDP	400	2B10	8.00	19.40	4.9110	0.17985
73	BLS	24	SDP	400	2B3	8.15	19.70	4.8710	0.25346
74	BLS	25	SDP	.	.	8.31	20.10	0.0525	0.00397
75	FAM	0	SDP	.	.	7.89	20.80	0.1820	0.00576
76	FAM	6	SDP	0	1A1	8.30	19.40	0.1370	0.00966
77	FAM	6	SDP	0	1A7	8.30	19.10	0.0820	0.00566
78	FAM	6	SDP	0	1B10	8.32	19.50	0.0770	0.00570
79	FAM	6	SDP	0	1B5	8.34	19.40	0.0840	0.00645
80	FAM	6	SDP	50	1A3	8.22	19.30	0.1860	0.01096
81	FAM	6	SDP	50	1A9	8.28	19.30	0.2030	0.01362
82	FAM	6	SDP	50	1B1	8.19	19.50	0.1620	0.00907
83	FAM	6	SDP	50	1B6	8.26	19.30	0.1490	0.00957
84	FAM	6	SDP	100	1A11	8.20	19.50	0.4030	0.02306
85	FAM	6	SDP	100	1A2	8.17	19.30	0.2420	0.01279
86	FAM	6	SDP	100	1B11	8.27	19.40	0.2520	0.01666
87	FAM	6	SDP	100	1B3	8.24	19.40	0.2420	0.01500
88	FAM	6	SDP	200	1A12	8.15	19.50	0.6190	0.03177
89	FAM	6	SDP	200	1A5	8.25	18.80	0.5820	0.03536
90	FAM	6	SDP	200	1B7	8.24	19.10	0.5660	0.03436
91	FAM	6	SDP	200	1B9	8.15	19.40	0.5690	0.02900
92	FAM	6	SDP	300	1A10	8.09	19.50	0.7190	0.03235
93	FAM	6	SDP	300	1A4	8.12	19.10	0.7530	0.03519
94	FAM	6	SDP	300	1B12	8.20	19.70	0.7510	0.04357
95	FAM	6	SDP	300	1B4	8.12	19.40	0.7740	0.03694
96	FAM	6	SDP	400	1A6	8.22	18.80	0.6980	0.03974
97	FAM	6	SDP	400	1A8	8.17	19.10	0.6650	0.03467
98	FAM	6	SDP	400	1B2	8.34	19.30	0.6980	0.05323
99	FAM	6	SDP	400	1B8	8.12	19.30	0.7980	0.03782
100	FAM	12	SDP	0	1A1	8.38	19.60	0.0680	0.00576

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	FAM	12	SDP	0	1A7	8.38	19.40	0.0490	0.00409
102	FAM	12	SDP	0	1B10	8.35	19.80	0.0890	0.00717
103	FAM	12	SDP	0	1B5	8.38	19.80	0.0600	0.00515
104	FAM	12	SDP	50	1A3	8.11	19.50	0.0640	0.00301
105	FAM	12	SDP	50	1A9	8.27	19.60	0.1350	0.00905
106	FAM	12	SDP	50	1B1	8.12	19.90	0.0980	0.00484
107	FAM	12	SDP	50	1B6	8.20	19.70	0.0580	0.00336
108	FAM	12	SDP	100	1A11	8.04	19.80	0.0660	0.00272
109	FAM	12	SDP	100	1A2	8.01	19.60	0.0520	0.00197
110	FAM	12	SDP	100	1B11	8.18	19.70	0.1650	0.00917
111	FAM	12	SDP	100	1B3	8.05	19.80	0.0590	0.00248
112	FAM	12	SDP	200	1A12	7.87	19.90	0.4190	0.01190
113	FAM	12	SDP	200	1A5	8.13	19.10	0.4060	0.01939
114	FAM	12	SDP	200	1B7	8.02	19.50	0.2170	0.00837
115	FAM	12	SDP	200	1B9	7.81	19.80	0.5670	0.01398
116	FAM	12	SDP	300	1A10	7.85	19.80	0.6720	0.01812
117	FAM	12	SDP	300	1A4	7.85	19.40	0.7350	0.01926
118	FAM	12	SDP	300	1B12	7.97	20.00	0.8800	0.03146
119	FAM	12	SDP	300	1B4	7.81	19.80	0.8280	0.02041
120	FAM	12	SDP	400	1A6	8.05	19.00	0.6610	0.02629
121	FAM	12	SDP	400	1A8	7.87	19.60	0.6770	0.01882
122	FAM	12	SDP	400	1B2	7.83	19.70	0.8130	0.02081
123	FAM	12	SDP	400	1B8	7.73	19.70	1.0250	0.02095
124	FAM	24	SDP	0	1A1	8.27	19.10	0.0630	0.00408
125	FAM	24	SDP	0	1A7	8.31	18.70	0.0500	0.00343
126	FAM	24	SDP	0	1B10	8.33	19.30	0.1030	0.00769
127	FAM	24	SDP	0	1B5	8.35	19.20	0.0880	0.00681
128	FAM	24	SDP	50	1A3	8.18	19.00	0.7500	0.03969
129	FAM	24	SDP	50	1A9	8.28	19.00	0.5040	0.03312
130	FAM	24	SDP	50	1B1	8.15	19.40	0.7490	0.03817
131	FAM	24	SDP	50	1B6	8.25	19.20	0.8660	0.05409
132	FAM	24	SDP	100	1A11	8.19	19.20	1.6180	0.08873
133	FAM	24	SDP	100	1A2	8.14	19.00	1.3520	0.06555
134	FAM	24	SDP	100	1B11	8.23	19.20	1.4000	0.08374
135	FAM	24	SDP	100	1B3	8.14	19.20	1.5090	0.07419

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	FAM	24	SDP	200	1A12	8.13	19.30	3.3600	0.16276
137	FAM	24	SDP	200	1A5	8.17	18.50	3.1700	0.15847
138	FAM	24	SDP	200	1B7	7.99	19.00	2.5690	0.08944
139	FAM	24	SDP	200	1B9	7.95	19.30	3.5200	0.11453
140	FAM	24	SDP	300	1A10	7.82	19.20	4.0340	0.09743
141	FAM	24	SDP	300	1A4	7.81	18.70	3.3480	0.07627
142	FAM	24	SDP	300	1B12	8.03	19.40	5.0370	0.19714
143	FAM	24	SDP	300	1B4	7.92	19.20	4.5100	0.13628
144	FAM	24	SDP	400	1A6	8.12	18.50	3.6640	0.16414
145	FAM	24	SDP	400	1A8	7.81	19.00	5.1350	0.11953
146	FAM	24	SDP	400	1B2	8.08	19.20	3.7590	0.16200
147	FAM	24	SDP	400	1B8	7.83	19.10	4.0410	0.09910
148	FAM	25	SDP	.	.	8.03	20.50	0.0940	0.00397
149	HGE	0	SDP	.	.	8.22	20.50	0.0560	0.00358
150	HGE	6	SDP	0	1A1	8.33	20.00	0.0190	0.00149
151	HGE	6	SDP	0	1A8	8.38	19.80	0.0280	0.00240
152	HGE	6	SDP	0	1B1	8.37	19.70	0.0220	0.00184
153	HGE	6	SDP	0	1B8	8.37	19.80	0.0320	0.00269
154	HGE	6	SDP	50	1A10	8.28	20.00	0.0680	0.00478
155	HGE	6	SDP	50	1A6	8.29	19.80	0.0730	0.00518
156	HGE	6	SDP	50	1B10	8.20	20.00	0.1700	0.01007
157	HGE	6	SDP	50	1B4	8.25	19.80	0.0320	0.00208
158	HGE	6	SDP	100	1A3	8.29	19.90	0.1110	0.00793
159	HGE	6	SDP	100	1A9	8.25	19.90	0.0560	0.00367
160	HGE	6	SDP	100	1B3	8.29	19.80	0.0960	0.00681
161	HGE	6	SDP	100	1B9	8.32	19.90	0.0990	0.00754
162	HGE	6	SDP	200	1A11	8.23	20.10	0.1670	0.01063
163	HGE	6	SDP	200	1A4	8.24	20.00	0.1540	0.00994
164	HGE	6	SDP	200	1B2	8.23	19.90	0.1510	0.00948
165	HGE	6	SDP	200	1B5	8.25	19.90	0.1700	0.01114
166	HGE	6	SDP	300	1A12	8.26	20.10	0.1880	0.01276
167	HGE	6	SDP	300	1A2	8.27	19.90	0.2260	0.01546
168	HGE	6	SDP	300	1B12	8.17	20.30	0.2550	0.01445
169	HGE	6	SDP	300	1B6	8.25	19.90	0.1890	0.01238
170	HGE	6	SDP	400	1A5	8.21	19.80	0.2350	0.01403

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	HGE	6	SDP	400	1A7	8.22	19.90	0.2050	0.01259
172	HGE	6	SDP	400	1B11	8.19	20.10	0.1750	0.01021
173	HGE	6	SDP	400	1B7	8.15	19.80	0.2160	0.01132
174	HGE	12	SDP	0	1A1	8.36	20.10	0.0310	0.00260
175	HGE	12	SDP	0	1A8	8.40	20.10	0.0170	0.00155
176	HGE	12	SDP	0	1B1	8.40	20.10	0.0130	0.00119
177	HGE	12	SDP	0	1B8	8.40	20.00	0.0240	0.00218
178	HGE	12	SDP	50	1A10	8.08	20.20	0.0650	0.00300
179	HGE	12	SDP	50	1A6	8.07	20.00	0.0500	0.00223
180	HGE	12	SDP	50	1B10	7.87	20.20	0.0270	0.00078
181	HGE	12	SDP	50	1B4	8.12	20.10	0.0990	0.00496
182	HGE	12	SDP	100	1A3	8.04	20.10	0.0650	0.00273
183	HGE	12	SDP	100	1A9	7.95	20.20	0.0660	0.00229
184	HGE	12	SDP	100	1B3	8.00	20.10	0.1610	0.00619
185	HGE	12	SDP	100	1B9	8.07	20.10	0.2070	0.00929
186	HGE	12	SDP	200	1A11	7.85	20.20	0.1590	0.00441
187	HGE	12	SDP	200	1A4	7.96	20.10	0.0860	0.00303
188	HGE	12	SDP	200	1B2	7.83	20.00	0.1290	0.00337
189	HGE	12	SDP	200	1B5	7.82	20.10	0.3890	0.01002
190	HGE	12	SDP	300	1A12	8.01	20.30	0.1580	0.00630
191	HGE	12	SDP	300	1A2	7.98	20.10	0.2820	0.01038
192	HGE	12	SDP	300	1B12	7.71	20.50	0.4390	0.00908
193	HGE	12	SDP	300	1B6	8.03	20.10	0.1780	0.00732
194	HGE	12	SDP	400	1A5	7.88	19.90	0.3470	0.01008
195	HGE	12	SDP	400	1A7	7.94	20.00	0.1860	0.00622
196	HGE	12	SDP	400	1B11	7.76	20.30	0.0870	0.00199
197	HGE	12	SDP	400	1B7	7.73	20.10	0.4920	0.01035
198	HGE	24	SDP	0	1A1	8.36	20.10	0.0560	0.00470
199	HGE	24	SDP	0	1A8	8.39	20.10	0.0620	0.00555
200	HGE	24	SDP	0	1B1	8.38	20.10	0.0560	0.00490
201	HGE	24	SDP	0	1B8	8.40	20.00	0.0580	0.00526
202	HGE	24	SDP	50	1A10	8.25	20.10	0.2900	0.01926
203	HGE	24	SDP	50	1A6	8.28	20.00	0.2720	0.01914
204	HGE	24	SDP	50	1B10	8.19	20.10	0.2030	0.01185
205	HGE	24	SDP	50	1B4	8.10	20.00	0.0640	0.00305

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	HGE	24	SDP	100	1A3	8.26	20.00	1.5900	0.10718
207	HGE	24	SDP	100	1A9	8.21	20.10	0.4110	0.02505
208	HGE	24	SDP	100	1B3	8.22	20.00	1.4490	0.08962
209	HGE	24	SDP	100	1B9	8.30	20.00	1.4180	0.10413
210	HGE	24	SDP	200	1A11	7.91	20.20	2.2470	0.07128
211	HGE	24	SDP	200	1A4	8.06	20.00	1.8820	0.08209
212	HGE	24	SDP	200	1B2	7.93	20.00	1.8260	0.05972
213	HGE	24	SDP	200	1B5	8.04	20.00	2.9250	0.12208
214	HGE	24	SDP	300	1A12	8.05	20.20	3.4620	0.14980
215	HGE	24	SDP	300	1A2	7.83	20.00	2.7390	0.07163
216	HGE	24	SDP	300	1B12	7.81	20.40	2.2830	0.05874
217	HGE	24	SDP	300	1B6	7.89	20.00	1.5160	0.04535
218	HGE	24	SDP	400	1A5	8.06	20.00	3.9550	0.17251
219	HGE	24	SDP	400	1A7	8.14	20.00	2.9010	0.15080
220	HGE	24	SDP	400	1B11	7.98	20.20	3.6310	0.13459
221	HGE	24	SDP	400	1B7	7.97	20.00	3.6130	0.12915
222	HGE	25	SDP	.	.	8.28	20.20	0.0570	0.00407
223	HIC	0	FDP	.	.	8.35	20.90	0.0400	0.00347
224	HIC	1	FDP	0	.	8.18	20.10	0.0220	0.00126
225	HIC	1	FDP	50	.	8.11	20.20	0.0330	0.00163
226	HIC	1	FDP	100	.	8.06	20.30	0.0450	0.00200
227	HIC	1	FDP	200	.	7.99	20.30	0.0690	0.00263
228	HIC	1	FDP	300	.	7.91	20.30	0.1040	0.00332
229	HIC	1	FDP	400	.	7.91	20.30	0.0960	0.00307
230	HIC	6	FDP	0	1A2	8.39	19.00	0.0130	0.00108
231	HIC	6	FDP	0	1A5	8.40	19.00	0.0150	0.00127
232	HIC	6	FDP	0	1B12	8.38	19.30	0.0210	0.00174
233	HIC	6	FDP	0	1B2	8.40	19.00	0.0160	0.00136
234	HIC	6	FDP	50	1A4	8.35	19.00	0.0630	0.00481
235	HIC	6	FDP	50	1A7	8.35	19.10	0.0310	0.00238
236	HIC	6	FDP	50	1B11	8.36	19.10	0.0340	0.00267
237	HIC	6	FDP	50	1B9	8.36	19.10	0.0390	0.00306
238	HIC	6	FDP	100	1A6	8.35	19.00	0.0540	0.00412
239	HIC	6	FDP	100	1A9	8.34	19.20	0.0620	0.00470
240	HIC	6	FDP	100	1B10	8.34	19.00	0.0540	0.00404

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	HIC	6	FDP	100	1B3	8.30	19.00	0.0360	0.00247
242	HIC	6	FDP	200	1A1	8.33	19.00	0.1090	0.00797
243	HIC	6	FDP	200	1A11	8.35	19.20	0.0840	0.00650
244	HIC	6	FDP	200	1B5	8.34	19.00	0.0930	0.00695
245	HIC	6	FDP	200	1B8	8.32	19.20	0.0980	0.00711
246	HIC	6	FDP	300	1A12	8.23	19.30	0.1540	0.00927
247	HIC	6	FDP	300	1A3	8.30	19.00	0.1400	0.00960
248	HIC	6	FDP	300	1B1	8.27	19.00	0.1390	0.00894
249	HIC	6	FDP	300	1B4	8.27	19.00	0.3050	0.01962
250	HIC	6	FDP	400	1A10	8.30	19.20	0.0940	0.00654
251	HIC	6	FDP	400	1A8	8.31	19.20	0.0880	0.00625
252	HIC	6	FDP	400	1B6	8.29	19.10	0.0820	0.00554
253	HIC	6	FDP	400	1B7	8.30	19.10	0.0830	0.00573
254	HIC	12	FDP	0	1A2	8.26	18.30	0.0170	0.00102
255	HIC	12	FDP	0	1A5	8.34	18.30	0.0120	0.00085
256	HIC	12	FDP	0	1B12	8.34	18.70	0.0330	0.00242
257	HIC	12	FDP	0	1B2	8.36	18.20	0.0220	0.00162
258	HIC	12	FDP	50	1A4	8.21	18.30	0.2060	0.01108
259	HIC	12	FDP	50	1A7	8.17	18.50	0.1310	0.00655
260	HIC	12	FDP	50	1B11	8.21	18.50	0.0760	0.00415
261	HIC	12	FDP	50	1B9	8.18	18.40	0.0790	0.00401
262	HIC	12	FDP	100	1A6	8.15	18.30	0.0680	0.00321
263	HIC	12	FDP	100	1A9	8.09	18.60	0.1290	0.00545
264	HIC	12	FDP	100	1B10	8.10	18.40	0.0710	0.00302
265	HIC	12	FDP	100	1B3	8.08	18.30	0.0220	0.00089
266	HIC	12	FDP	200	1A1	8.11	18.30	0.5080	0.02195
267	HIC	12	FDP	200	1A11	8.15	18.70	0.1510	0.00733
268	HIC	12	FDP	200	1B5	8.12	18.30	0.0660	0.00292
269	HIC	12	FDP	200	1B8	8.12	18.40	0.0080	0.00036
270	HIC	12	FDP	300	1A12	7.88	18.70	0.4660	0.01242
271	HIC	12	FDP	300	1A3	7.98	18.30	0.3240	0.01050
272	HIC	12	FDP	300	1B1	7.95	18.40	0.3250	0.00992
273	HIC	12	FDP	300	1B4	7.93	18.30	0.3530	0.01023
274	HIC	12	FDP	400	1A10	8.03	18.80	0.0680	0.00255
275	HIC	12	FDP	400	1A8	7.95	18.60	0.1170	0.00362

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	HIC	12	FDP	400	1B6	7.81	18.40	0.0640	0.00143
277	HIC	12	FDP	400	1B7	7.90	18.40	0.0640	0.00175
278	HIC	24	FDP	0	1A2	8.30	18.30	0.0170	0.00111
279	HIC	24	FDP	0	1A5	8.33	18.20	0.0120	0.00083
280	HIC	24	FDP	0	1B12	8.33	18.70	0.0100	0.00072
281	HIC	24	FDP	0	1B2	8.35	18.20	0.0220	0.00159
282	HIC	24	FDP	50	1A4	8.26	18.20	1.2100	0.07205
283	HIC	24	FDP	50	1A7	8.22	18.50	1.1740	0.06545
284	HIC	24	FDP	50	1B11	8.27	18.60	1.3520	0.08458
285	HIC	24	FDP	50	1B9	8.24	18.50	1.3020	0.07581
286	HIC	24	FDP	100	1A6	8.17	18.30	3.6570	0.18027
287	HIC	24	FDP	100	1A9	8.17	18.50	3.7140	0.18567
288	HIC	24	FDP	100	1B10	8.16	18.50	3.1300	0.15308
289	HIC	24	FDP	100	1B3	8.06	18.30	3.5110	0.13584
290	HIC	24	FDP	200	1A1	8.21	18.30	8.3130	0.44718
291	HIC	24	FDP	200	1A11	8.17	18.50	8.1810	0.40898
292	HIC	24	FDP	200	1B5	8.08	18.30	6.7440	0.27273
293	HIC	24	FDP	200	1B8	8.14	18.40	7.9680	0.37037
294	HIC	24	FDP	300	1A12	8.03	18.70	11.5000	0.42834
295	HIC	24	FDP	300	1A3	8.04	18.20	11.2440	0.41323
296	HIC	24	FDP	300	1B1	7.99	18.20	9.0280	0.29689
297	HIC	24	FDP	300	1B4	7.95	18.30	10.2350	0.31008
298	HIC	24	FDP	400	1A10	8.00	18.50	11.6300	0.39954
299	HIC	24	FDP	400	1A8	8.00	18.60	11.7800	0.40759
300	HIC	24	FDP	400	1B6	8.02	18.30	11.9060	0.42155
301	HIC	24	FDP	400	1B7	7.97	18.30	11.3040	0.35809
302	HIC	25	FDP	.	.	8.29	19.30	0.1000	0.00685
303	MUC	0	FDP	.	.	8.28	19.60	0.0800	0.00548
304	MUC	1	FDP	0	.	8.09	20.20	0.0110	0.00052
305	MUC	1	FDP	50	.	8.04	20.10	0.0220	0.00092
306	MUC	1	FDP	100	.	8.01	19.90	0.0330	0.00128
307	MUC	1	FDP	200	.	7.94	19.80	0.0570	0.00188
308	MUC	1	FDP	300	.	7.89	19.90	0.0830	0.00247
309	MUC	1	FDP	400	.	7.78	19.90	0.0800	0.00186
310	MUC	6	FDP	0	2A11	8.32	18.30	0.0210	0.00143

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	MUC	6	FDP	0	2A4	8.30	18.80	0.0180	0.00122
312	MUC	6	FDP	0	2B10	8.36	18.20	0.0180	0.00133
313	MUC	6	FDP	0	2B7	8.35	18.40	0.0170	0.00125
314	MUC	6	FDP	50	2A10	8.31	18.30	0.0580	0.00387
315	MUC	6	FDP	50	2A3	8.33	18.80	0.0420	0.00303
316	MUC	6	FDP	50	2B5	8.31	18.50	0.0800	0.00542
317	MUC	6	FDP	50	2B9	8.32	18.20	0.0430	0.00291
318	MUC	6	FDP	100	2A6	8.16	18.60	0.2250	0.01108
319	MUC	6	FDP	100	2A7	8.34	18.60	0.0610	0.00444
320	MUC	6	FDP	100	2B3	8.36	18.30	0.0750	0.00558
321	MUC	6	FDP	100	2B8	8.30	18.30	0.0610	0.00399
322	MUC	6	FDP	200	2A1	8.25	19.10	0.1060	0.00657
323	MUC	6	FDP	200	2A5	8.30	18.70	0.1100	0.00739
324	MUC	6	FDP	200	2B11	8.28	18.30	0.1090	0.00682
325	MUC	6	FDP	200	2B12	8.24	18.50	0.1030	0.00600
326	MUC	6	FDP	300	2A2	8.27	18.80	0.1510	0.00958
327	MUC	6	FDP	300	2A9	8.26	18.40	0.1870	0.01129
328	MUC	6	FDP	300	2B2	8.29	18.30	0.1380	0.00883
329	MUC	6	FDP	300	2B4	8.26	18.40	0.1500	0.00906
330	MUC	6	FDP	400	2A12	8.23	18.30	0.1000	0.00562
331	MUC	6	FDP	400	2A8	8.20	18.60	0.1050	0.00564
332	MUC	6	FDP	400	2B1	8.26	18.40	0.0870	0.00525
333	MUC	6	FDP	400	2B6	8.27	18.40	0.0930	0.00574
334	MUC	12	FDP	0	2A11	8.36	18.10	0.0510	0.00374
335	MUC	12	FDP	0	2A4	8.35	18.70	0.0170	0.00127
336	MUC	12	FDP	0	2B10	8.37	18.00	0.0220	0.00164
337	MUC	12	FDP	0	2B7	8.38	18.20	0.0190	0.00146
338	MUC	12	FDP	50	2A10	8.15	18.20	0.1620	0.00759
339	MUC	12	FDP	50	2A3	8.23	18.70	0.1500	0.00867
340	MUC	12	FDP	50	2B5	8.22	18.30	0.1240	0.00682
341	MUC	12	FDP	50	2B9	8.24	18.10	0.1320	0.00747
342	MUC	12	FDP	100	2A6	7.92	18.60	1.5670	0.04536
343	MUC	12	FDP	100	2A7	8.24	18.40	0.1410	0.00815
344	MUC	12	FDP	100	2B3	8.28	18.30	0.1620	0.01014
345	MUC	12	FDP	100	2B8	8.21	18.20	0.2640	0.01410

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	MUC	12	FDP	200	2A1	8.00	18.80	0.4350	0.01527
347	MUC	12	FDP	200	2A5	8.16	18.60	0.2850	0.01404
348	MUC	12	FDP	200	2B11	8.13	18.30	0.3700	0.01671
349	MUC	12	FDP	200	2B12	8.03	18.50	0.3420	0.01256
350	MUC	12	FDP	300	2A2	8.12	18.70	0.5310	0.02413
351	MUC	12	FDP	300	2A9	8.06	18.30	0.3750	0.01451
352	MUC	12	FDP	300	2B2	8.13	18.20	0.6000	0.02690
353	MUC	12	FDP	300	2B4	8.05	18.30	0.4730	0.01790
354	MUC	12	FDP	400	2A12	7.92	18.10	0.2090	0.00584
355	MUC	12	FDP	400	2A8	7.95	18.30	0.1520	0.00460
356	MUC	12	FDP	400	2B1	7.98	18.20	0.1240	0.00399
357	MUC	12	FDP	400	2B6	8.00	18.30	0.1280	0.00434
358	MUC	24	FDP	0	2A11	8.30	18.30	0.0130	0.00085
359	MUC	24	FDP	0	2A4	8.12	18.80	0.0120	0.00055
360	MUC	24	FDP	0	2B10	8.35	18.20	0.0110	0.00079
361	MUC	24	FDP	0	2B7	8.32	18.30	0.0120	0.00082
362	MUC	24	FDP	50	2A10	8.18	18.30	1.2660	0.06379
363	MUC	24	FDP	50	2A3	8.26	18.80	1.4950	0.09281
364	MUC	24	FDP	50	2B5	8.22	18.50	1.2710	0.07086
365	MUC	24	FDP	50	2B9	8.25	18.20	1.3950	0.08129
366	MUC	24	FDP	100	2A6	8.21	18.70	4.2120	0.23300
367	MUC	24	FDP	100	2A7	8.26	18.60	4.1330	0.25304
368	MUC	24	FDP	100	2B3	8.30	18.40	2.4770	0.16305
369	MUC	24	FDP	100	2B8	8.27	18.30	3.9990	0.24504
370	MUC	24	FDP	200	2A1	8.23	18.90	8.8000	0.51552
371	MUC	24	FDP	200	2A5	8.13	18.70	10.1650	0.47210
372	MUC	24	FDP	200	2B11	8.13	18.40	7.1680	0.32594
373	MUC	24	FDP	200	2B12	8.13	18.60	7.0830	0.32665
374	MUC	24	FDP	300	2A2	8.12	18.80	12.3730	0.56613
375	MUC	24	FDP	300	2A9	8.07	18.50	9.6960	0.38902
376	MUC	24	FDP	300	2B2	8.10	18.40	12.1300	0.51633
377	MUC	24	FDP	300	2B4	7.98	18.50	11.6100	0.38149
378	MUC	24	FDP	400	2A12	7.96	18.30	11.2370	0.34812
379	MUC	24	FDP	400	2A8	8.00	18.40	10.2080	0.34820
380	MUC	24	FDP	400	2B1	7.98	18.50	10.5330	0.34610

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	MUC	24	FDP	400	2B6	8.01	18.30	10.7030	0.37063
382	MUC	25	FDP	.	.	8.31	19.30	0.0600	0.00429
383	PPB	0	SDP	.	.	8.07	20.70	0.1080	0.00506
384	PPB	6	SDP	0	1A1	8.38	20.10	0.0860	0.00753
385	PPB	6	SDP	0	1A3	8.45	19.80	0.0930	0.00924
386	PPB	6	SDP	0	1B10	8.37	19.90	0.0970	0.00821
387	PPB	6	SDP	0	1B9	8.41	19.70	0.1070	0.00972
388	PPB	6	SDP	50	1A10	8.38	19.80	0.0890	0.00764
389	PPB	6	SDP	50	1A8	8.38	19.70	0.1150	0.00981
390	PPB	6	SDP	50	1B3	8.34	19.80	0.0880	0.00694
391	PPB	6	SDP	50	1B8	8.33	19.70	0.1010	0.00775
392	PPB	6	SDP	100	1A6	8.36	19.60	0.1340	0.01088
393	PPB	6	SDP	100	1A7	8.33	19.70	0.1330	0.01020
394	PPB	6	SDP	100	1B5	8.31	19.80	0.1070	0.00792
395	PPB	6	SDP	100	1B7	8.33	19.70	0.1160	0.00890
396	PPB	6	SDP	200	1A11	8.33	19.80	0.1590	0.01228
397	PPB	6	SDP	200	1A5	8.34	19.50	0.1600	0.01237
398	PPB	6	SDP	200	1B12	8.25	20.00	0.1040	0.00686
399	PPB	6	SDP	200	1B6	8.30	19.60	0.1450	0.01036
400	PPB	6	SDP	300	1A12	8.30	20.00	0.1470	0.01080
401	PPB	6	SDP	300	1A9	8.40	19.60	0.2000	0.01767
402	PPB	6	SDP	300	1B11	8.31	19.80	0.1760	0.01303
403	PPB	6	SDP	300	1B2	8.30	19.60	0.1970	0.01408
404	PPB	6	SDP	400	1A2	8.38	19.60	0.1530	0.01296
405	PPB	6	SDP	400	1A4	8.31	19.80	0.1730	0.01280
406	PPB	6	SDP	400	1B1	8.25	19.80	0.1160	0.00755
407	PPB	6	SDP	400	1B4	8.30	19.70	0.1610	0.01159
408	PPB	12	SDP	0	1A1	8.33	20.10	0.1040	0.00820
409	PPB	12	SDP	0	1A3	8.42	19.70	0.1170	0.01085
410	PPB	12	SDP	0	1B10	8.42	19.80	0.0930	0.00868
411	PPB	12	SDP	0	1B9	8.43	19.70	0.1050	0.00994
412	PPB	12	SDP	50	1A10	8.19	19.80	0.0960	0.00549
413	PPB	12	SDP	50	1A8	8.15	19.60	0.0920	0.00475
414	PPB	12	SDP	50	1B3	8.08	19.70	0.0900	0.00402
415	PPB	12	SDP	50	1B8	8.17	19.70	0.0900	0.00489

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	PPB	12	SDP	100	1A6	8.14	19.50	0.1220	0.00613
417	PPB	12	SDP	100	1A7	8.05	19.60	0.1020	0.00423
418	PPB	12	SDP	100	1B5	8.09	19.70	0.0870	0.00397
419	PPB	12	SDP	100	1B7	8.14	19.60	0.0980	0.00495
420	PPB	12	SDP	200	1A11	8.08	19.90	0.1110	0.00502
421	PPB	12	SDP	200	1A5	8.06	19.60	0.1020	0.00433
422	PPB	12	SDP	200	1B12	8.02	20.00	0.0850	0.00339
423	PPB	12	SDP	200	1B6	8.02	19.60	0.1040	0.00404
424	PPB	12	SDP	300	1A12	8.04	20.10	0.1200	0.00504
425	PPB	12	SDP	300	1A9	8.14	19.60	0.1110	0.00561
426	PPB	12	SDP	300	1B11	8.12	19.80	0.0930	0.00456
427	PPB	12	SDP	300	1B2	8.04	19.70	0.1070	0.00437
428	PPB	12	SDP	400	1A2	8.23	19.40	0.1230	0.00746
429	PPB	12	SDP	400	1A4	7.94	19.80	0.1590	0.00524
430	PPB	12	SDP	400	1B1	8.07	19.80	0.0870	0.00383
431	PPB	12	SDP	400	1B4	7.99	19.80	0.1150	0.00424
432	PPB	24	SDP	0	1A1	8.28	20.00	0.0890	0.00626
433	PPB	24	SDP	0	1A3	8.35	19.90	0.1180	0.00957
434	PPB	24	SDP	0	1B10	8.32	19.90	0.0680	0.00518
435	PPB	24	SDP	0	1B9	8.34	19.80	0.0540	0.00426
436	PPB	24	SDP	50	1A10	8.21	19.90	0.1880	0.01130
437	PPB	24	SDP	50	1A8	8.31	19.80	0.2330	0.01724
438	PPB	24	SDP	50	1B3	8.29	19.70	0.3290	0.02317
439	PPB	24	SDP	50	1B8	8.29	19.80	0.4010	0.02844
440	PPB	24	SDP	100	1A6	8.00	19.60	0.4120	0.01530
441	PPB	24	SDP	100	1A7	8.25	19.60	0.4920	0.03158
442	PPB	24	SDP	100	1B5	8.20	19.70	0.5720	0.03319
443	PPB	24	SDP	100	1B7	8.22	19.70	1.1760	0.07125
444	PPB	24	SDP	200	1A11	8.01	19.90	0.4380	0.01699
445	PPB	24	SDP	200	1A5	7.96	19.70	0.4180	0.01431
446	PPB	24	SDP	200	1B12	7.96	20.20	1.3050	0.04627
447	PPB	24	SDP	200	1B6	8.03	19.70	2.0590	0.08231
448	PPB	24	SDP	300	1A12	8.13	20.00	0.4930	0.02507
449	PPB	24	SDP	300	1A9	7.98	19.80	0.5140	0.01852
450	PPB	24	SDP	300	1B11	8.02	19.90	2.1940	0.08700

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	PPB	24	SDP	300	1B2	7.97	19.70	2.0160	0.07055
452	PPB	24	SDP	400	1A2	8.19	19.90	2.1180	0.12191
453	PPB	24	SDP	400	1A4	7.88	19.80	0.4980	0.01436
454	PPB	24	SDP	400	1B1	8.00	19.70	0.4110	0.01537
455	PPB	24	SDP	400	1B4	7.99	19.70	2.1140	0.07734
456	PPB	25	SDP	.	.	8.09	20.20	0.0520	0.00246
457	WAS	0	FDP	.	.	8.18	20.30	0.0890	0.00515
458	WAS	6	FDP	0	2A11	8.22	20.60	0.0700	0.00451
459	WAS	6	FDP	0	2A9	8.26	20.40	0.0650	0.00450
460	WAS	6	FDP	0	2B1	8.21	20.80	0.0800	0.00511
461	WAS	6	FDP	0	2B7	8.23	20.40	0.0820	0.00533
462	WAS	6	FDP	50	2A1	8.06	20.80	0.1270	0.00586
463	WAS	6	FDP	50	2A12	8.08	20.80	0.1510	0.00728
464	WAS	6	FDP	50	2B11	8.22	20.40	0.1710	0.01087
465	WAS	6	FDP	50	2B2	8.21	20.70	0.1940	0.01232
466	WAS	6	FDP	100	2A2	8.04	20.60	0.2930	0.01275
467	WAS	6	FDP	100	2A3	8.00	20.50	0.1270	0.00503
468	WAS	6	FDP	100	2B12	8.18	20.60	0.2550	0.01507
469	WAS	6	FDP	100	2B9	8.13	20.40	0.1880	0.00983
470	WAS	6	FDP	200	2A10	7.95	20.50	0.2320	0.00822
471	WAS	6	FDP	200	2A6	8.06	20.70	0.3290	0.01507
472	WAS	6	FDP	200	2B10	8.13	20.20	0.2860	0.01475
473	WAS	6	FDP	200	2B3	8.12	20.70	0.2630	0.01374
474	WAS	6	FDP	300	2A4	8.03	20.60	0.3020	0.01286
475	WAS	6	FDP	300	2A8	7.97	20.50	0.3740	0.01385
476	WAS	6	FDP	300	2B4	8.08	20.60	0.3390	0.01611
477	WAS	6	FDP	300	2B6	8.05	20.50	0.3380	0.01493
478	WAS	6	FDP	400	2A5	8.08	20.63	0.2640	0.01257
479	WAS	6	FDP	400	2A7	8.07	20.60	0.2510	0.01167
480	WAS	6	FDP	400	2B5	8.26	19.60	0.2470	0.01620
481	WAS	6	FDP	400	2B8	8.10	20.40	0.2320	0.01136
482	WAS	12	FDP	0	2A11	8.23	19.90	0.0710	0.00446
483	WAS	12	FDP	0	2A9	8.25	19.80	0.0790	0.00514
484	WAS	12	FDP	0	2B1	8.33	20.30	0.0760	0.00607
485	WAS	12	FDP	0	2B7	8.33	20.00	0.0950	0.00744

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	WAS	12	FDP	50	2A1	8.02	20.10		0.3200	0.01287
487	WAS	12	FDP	50	2A12	8.04	20.10		0.2340	0.00984
488	WAS	12	FDP	50	2B11	8.25	19.70		0.3890	0.02514
489	WAS	12	FDP	50	2B2	8.20	20.10		0.4440	0.02648
490	WAS	12	FDP	100	2A2	7.97	19.90		0.5630	0.01998
491	WAS	12	FDP	100	2A3	7.97	19.70		0.4300	0.01505
492	WAS	12	FDP	100	2B12	8.22	20.00		1.2000	0.07422
493	WAS	12	FDP	100	2B9	8.04	19.60		0.4030	0.01635
494	WAS	12	FDP	200	2A10	7.83	19.90		1.7040	0.04425
495	WAS	12	FDP	200	2A6	7.97	19.80		0.5760	0.02030
496	WAS	12	FDP	200	2B10	8.11	19.50		1.5270	0.07179
497	WAS	12	FDP	200	2B3	8.10	20.20		0.9790	0.04728
498	WAS	12	FDP	300	2A4	7.91	19.80		1.3890	0.04283
499	WAS	12	FDP	300	2A8	7.83	19.60		1.8480	0.04697
500	WAS	12	FDP	300	2B4	8.02	19.90		1.1690	0.04636
501	WAS	12	FDP	300	2B6	7.95	19.90		1.2070	0.04098
502	WAS	12	FDP	400	2A5	7.84	19.90		1.5470	0.04108
503	WAS	12	FDP	400	2A7	7.80	19.70		1.9250	0.04607
504	WAS	12	FDP	400	2B5	8.25	18.70		1.0730	0.06474
505	WAS	12	FDP	400	2B8	7.95	19.80		1.3910	0.04689
506	WAS	24	FDP	0	2A11	8.24	19.20		0.0340	0.00208
507	WAS	24	FDP	0	2A9	8.27	19.20		0.0370	0.00241
508	WAS	24	FDP	0	2B1	8.27	19.90		0.0530	0.00363
509	WAS	24	FDP	0	2B7	8.26	19.80		0.0150	0.00100
510	WAS	24	FDP	50	2A1	8.03	19.80		0.9930	0.03998
511	WAS	24	FDP	50	2A12	8.04	19.30		0.9800	0.03894
512	WAS	24	FDP	50	2B11	8.23	19.60		1.6700	0.10268
513	WAS	24	FDP	50	2B2	8.18	19.60		1.6310	0.08998
514	WAS	24	FDP	100	2A2	8.02	19.60		2.6410	0.10254
515	WAS	24	FDP	100	2A3	8.00	19.40		2.3080	0.08452
516	WAS	24	FDP	100	2B12	8.20	19.70		2.7440	0.15920
517	WAS	24	FDP	100	2B9	8.06	19.60		2.5350	0.10752
518	WAS	24	FDP	200	2A10	7.93	19.20		5.1190	0.15817
519	WAS	24	FDP	200	2A6	7.93	19.40		4.2880	0.13439
520	WAS	24	FDP	200	2B10	8.08	19.40		5.4240	0.23706

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	WAS	24	FDP	200	2B3	7.98	19.70	6.7410	0.24122
522	WAS	24	FDP	300	2A4	7.85	19.40	8.4600	0.22171
523	WAS	24	FDP	300	2A8	7.91	19.00	7.2690	0.21175
524	WAS	24	FDP	300	2B4	7.91	19.70	5.5930	0.17126
525	WAS	24	FDP	300	2B6	7.86	19.80	5.9280	0.16347
526	WAS	24	FDP	400	2A5	7.91	19.40	7.6930	0.23058
527	WAS	24	FDP	400	2A7	7.82	19.20	9.7190	0.23473
528	WAS	24	FDP	400	2B5	7.97	19.70	5.4350	0.19021
529	WAS	24	FDP	400	2B8	8.01	19.70	5.5270	0.21138
530	WAS	25	FDP	.	.	7.99	20.90	0.0250	0.00100

Performed by K. Weber SAS version 9.4 09:25 07MAY14

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Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical analysis of ammonia levels (TAN and un-ionized)
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW KLW

The MEANS Procedure

AEH-11-PSEUDO-02

sps=BLS time=6 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0420	0.0350	0.0470	0.00529	0.0336	0.0504
		un_ion		0.00293	0.00253	0.00317	0.000291	0.00247	0.00340
50	4	tan	tan	0.0578	0.0540	0.0620	0.00330	0.0525	0.0630
		un_ion		0.00400	0.00367	0.00439	0.000352	0.00344	0.00456
100	4	tan	tan	0.0875	0.0760	0.1000	0.0103	0.0710	0.1040
		un_ion		0.00539	0.00444	0.00584	0.000652	0.00435	0.00642
200	4	tan	tan	0.1235	0.1070	0.1380	0.0149	0.0998	0.1472
		un_ion		0.00698	0.00629	0.00828	0.000900	0.00555	0.00841
300	4	tan	tan	0.1598	0.1550	0.1640	0.00377	0.1537	0.1658
		un_ion		0.00942	0.00872	0.00977	0.000472	0.00867	0.0102
400	4	tan	tan	0.1610	0.1540	0.1670	0.00572	0.1519	0.1701
		un_ion		0.00882	0.00779	0.00979	0.000904	0.00739	0.0103

sps=BLS time=12 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0478	0.0420	0.0540	0.00506	0.0397	0.0558
		un_ion		0.00294	0.00250	0.00317	0.000303	0.00246	0.00342
50	4	tan	tan	0.0455	0.0350	0.0570	0.00988	0.0298	0.0612
		un_ion		0.00200	0.00147	0.00256	0.000494	0.00121	0.00278
100	4	tan	tan	0.0448	0.0380	0.0560	0.00780	0.0323	0.0572
		un_ion		0.00158	0.00125	0.00188	0.000335	0.00104	0.00211
200	4	tan	tan	0.0613	0.0440	0.0800	0.0148	0.0377	0.0848
		un_ion		0.00175	0.00116	0.00217	0.000490	0.000970	0.00253
300	4	tan	tan	0.1188	0.1030	0.1390	0.0151	0.0948	0.1427
		un_ion		0.00381	0.00326	0.00504	0.000841	0.00247	0.00515
400	4	tan	tan	0.0750	0.0680	0.0820	0.00577	0.0658	0.0842
		un_ion		0.00168	0.00130	0.00209	0.000371	0.00109	0.00227

sps=BLS time=24 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean

0	4	tan un_ion	tan	0.0665 0.00592	0.0580 0.00501	0.0840 0.00785	0.0119 0.00131	0.0475 0.00383	0.0855 0.00800
50	4	tan un_ion	tan	0.1928 0.0134	0.1750 0.0117	0.2170 0.0150	0.0199 0.00138	0.1611 0.0112	0.2244 0.0156
100	4	tan un_ion	tan	2.1605 0.1285	1.2920 0.0572	3.9280 0.2295	1.2132 0.0779	0.2300 0.00451	4.0910 0.2524
200	4	tan un_ion	tan	3.1348 0.1283	0.4580 0.0194	4.9180 0.2067	1.8995 0.0786	0.1122 0.00316	6.1573 0.2534
300	4	tan un_ion	tan	4.2643 0.1480	3.7780 0.1124	4.9670 0.2046	0.5053 0.0397	3.4602 0.0848	5.0683 0.2112
400	4	tan un_ion	tan	4.9863 0.2093	4.8710 0.1435	5.1530 0.2603	0.1256 0.0570	4.7864 0.1185	5.1861 0.3000

sps=FAM time=6 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0950 0.00687	0.0770 0.00566	0.1370 0.00966	0.0282 0.00189	0.0502 0.00385	0.1398 0.00988
50	4	tan un_ion	tan	0.1750 0.0108	0.1490 0.00907	0.2030 0.0136	0.0242 0.00204	0.1366 0.00756	0.2134 0.0140
100	4	tan un_ion	tan	0.2848 0.0169	0.2420 0.0128	0.4030 0.0231	0.0790 0.00442	0.1591 0.00985	0.4104 0.0239
200	4	tan un_ion	tan	0.5840 0.0326	0.5660 0.0290	0.6190 0.0354	0.0243 0.00285	0.5453 0.0281	0.6227 0.0372
300	4	tan un_ion	tan	0.7493 0.0370	0.7190 0.0323	0.7740 0.0436	0.0227 0.00476	0.7131 0.0294	0.7854 0.0446
400	4	tan un_ion	tan	0.7148 0.0414	0.6650 0.0347	0.7980 0.0532	0.0576 0.00818	0.6230 0.0283	0.8065 0.0544

sps=FAM time=12 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0665 0.00554	0.0490 0.00409	0.0890 0.00717	0.0169 0.00128	0.0396 0.00350	0.0934 0.00759
50	4	tan un_ion	tan	0.0888 0.00507	0.0580 0.00301	0.1350 0.00905	0.0355 0.00277	0.0322 0.000657	0.1453 0.00947
100	4	tan un_ion	tan	0.0855 0.00408	0.0520 0.00197	0.1650 0.00917	0.0533 0.00340	0.000676 -0.00133	0.1703 0.00950
200	4	tan un_ion	tan	0.4023 0.0134	0.2170 0.00837	0.5670 0.0194	0.1435 0.00461	0.1740 0.00607	0.6305 0.0207
300	4	tan un_ion	tan	0.7788 0.0223	0.6720 0.0181	0.8800 0.0315	0.0931 0.00617	0.6307 0.0125	0.9268 0.0321

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400	4	tan un_ion	tan	0.7940 0.0217	0.6610 0.0188	1.0250 0.0263	0.1684 0.00320	0.5260 0.0166	1.0620 0.0268

sps=FAM time=24 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0760 0.00550	0.0500 0.00343	0.1030 0.00769	0.0239 0.00207	0.0379 0.00222	0.1141 0.00879
50	4	tan un_ion	tan	0.7173 0.0413	0.5040 0.0331	0.8660 0.0541	0.1524 0.00900	0.4747 0.0270	0.9598 0.0556
100	4	tan un_ion	tan	1.4698 0.0781	1.3520 0.0655	1.6180 0.0887	0.1187 0.0103	1.2809 0.0617	1.6586 0.0944
200	4	tan un_ion	tan	3.1548 0.1313	2.5690 0.0894	3.5200 0.1628	0.4159 0.0354	2.4930 0.0750	3.8165 0.1876
300	4	tan un_ion	tan	4.2323 0.1268	3.3480 0.0763	5.0370 0.1971	0.7179 0.0531	3.0900 0.0423	5.3745 0.2112
400	4	tan un_ion	tan	4.1498 0.1362	3.6640 0.0991	5.1350 0.1641	0.6761 0.0321	3.0740 0.0850	5.2255 0.1873

sps=HGE time=6 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0253 0.00210	0.0190 0.00149	0.0320 0.00269	0.00585 0.000543	0.0159 0.00124	0.0346 0.00297
50	4	tan un_ion	tan	0.0858 0.00553	0.0320 0.00208	0.1700 0.0101	0.0591 0.00332	-0.00823 0.000238	0.1797 0.0108
100	4	tan un_ion	tan	0.0905 0.00648	0.0560 0.00367	0.1110 0.00793	0.0239 0.00193	0.0525 0.00341	0.1285 0.00956
200	4	tan un_ion	tan	0.1605 0.0103	0.1510 0.00948	0.1700 0.0111	0.00940 0.000734	0.1455 0.00913	0.1755 0.0115
300	4	tan un_ion	tan	0.2145 0.0138	0.1880 0.0124	0.2550 0.0155	0.0323 0.00144	0.1631 0.0115	0.2659 0.0161
400	4	tan un_ion	tan	0.2078 0.0120	0.1750 0.0102	0.2350 0.0140	0.0251 0.00165	0.1678 0.00942	0.2477 0.0147

sps=HGE time=12 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0213 0.00188	0.0130 0.00119	0.0310 0.00260	0.00793 0.000632	0.00863 0.000874	0.0339 0.00289
50	4	tan	tan	0.0603	0.0270	0.0990	0.0302	0.0122	0.1083

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conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
		un_ion		0.00274	0.000783	0.00496	0.00174	-0.00003	0.00551
100	4	tan	tan	0.1248	0.0650	0.2070	0.0709	0.0119	0.2376
		un_ion		0.00513	0.00229	0.00929	0.00328	-0.00009	0.0103
200	4	tan	tan	0.1908	0.0860	0.3890	0.1355	-0.0249	0.4064
		un_ion		0.00521	0.00303	0.0100	0.00326	0.000019	0.0104
300	4	tan	tan	0.2643	0.1580	0.4390	0.1286	0.0597	0.4688
		un_ion		0.00827	0.00630	0.0104	0.00182	0.00538	0.0112
400	4	tan	tan	0.2780	0.0870	0.4920	0.1784	-0.00591	0.5619
		un_ion		0.00716	0.00199	0.0104	0.00393	0.000904	0.0134

sps=HGE time=24 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0580	0.0560	0.0620	0.00283	0.0535	0.0625
		un_ion		0.00510	0.00470	0.00555	0.000375	0.00451	0.00570
50	4	tan	tan	0.2073	0.0640	0.2900	0.1026	0.0440	0.3705
		un_ion		0.0133	0.00305	0.0193	0.00768	0.00111	0.0255
100	4	tan	tan	1.2170	0.4110	1.5900	0.5425	0.3537	2.0803
		un_ion		0.0815	0.0250	0.1072	0.0384	0.0204	0.1426
200	4	tan	tan	2.2200	1.8260	2.9250	0.5057	1.4153	3.0247
		un_ion		0.0838	0.0597	0.1221	0.0271	0.0407	0.1269
300	4	tan	tan	2.5000	1.5160	3.4620	0.8161	1.2015	3.7985
		un_ion		0.0814	0.0453	0.1498	0.0469	0.00682	0.1559
400	4	tan	tan	3.5250	2.9010	3.9550	0.4447	2.8174	4.2326
		un_ion		0.1468	0.1292	0.1725	0.0195	0.1158	0.1778

sps=HIC time=6 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0163	0.0130	0.0210	0.00340	0.0108	0.0217
		un_ion		0.00136	0.00108	0.00174	0.000279	0.000920	0.00181
50	4	tan	tan	0.0418	0.0310	0.0630	0.0145	0.0186	0.0649
		un_ion		0.00323	0.00238	0.00481	0.00109	0.00150	0.00496
100	4	tan	tan	0.0515	0.0360	0.0620	0.0110	0.0340	0.0690
		un_ion		0.00383	0.00247	0.00470	0.000954	0.00231	0.00535
200	4	tan	tan	0.0960	0.0840	0.1090	0.0104	0.0794	0.1126
		un_ion		0.00713	0.00650	0.00797	0.000617	0.00615	0.00812
300	4	tan	tan	0.1845	0.1390	0.3050	0.0806	0.0562	0.3128
		un_ion		0.0119	0.00894	0.0196	0.00518	0.00362	0.0201
400	4	tan	tan	0.0868	0.0820	0.0940	0.00550	0.0780	0.0955
		un_ion		0.00602	0.00554	0.00654	0.000459	0.00529	0.00675

sps=HIC time=12 form=FDP

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conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0210	0.0120	0.0330	0.00898	0.00671	0.0353
		un_ion		0.00148	0.000855	0.00242	0.000707	0.000353	0.00260
50	4	tan	tan	0.1230	0.0760	0.2060	0.0608	0.0262	0.2198
		un_ion		0.00645	0.00401	0.0111	0.00330	0.00119	0.0117
100	4	tan	tan	0.0725	0.0220	0.1290	0.0438	0.00275	0.1423
		un_ion		0.00314	0.000890	0.00545	0.00186	0.000178	0.00611
200	4	tan	tan	0.1833	0.00800	0.5080	0.2243	-0.1737	0.5402
		un_ion		0.00814	0.000356	0.0219	0.00965	-0.00722	0.0235
300	4	tan	tan	0.3670	0.3240	0.4660	0.0674	0.2598	0.4742
		un_ion		0.0108	0.00992	0.0124	0.00113	0.00897	0.0126
400	4	tan	tan	0.0783	0.0640	0.1170	0.0259	0.0370	0.1195
		un_ion		0.00234	0.00143	0.00362	0.000979	0.000779	0.00389

sps=HIC time=24 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0153	0.0100	0.0220	0.00538	0.00669	0.0238
		un_ion		0.00106	0.000717	0.00159	0.000389	0.000443	0.00168
50	4	tan	tan	1.2595	1.1740	1.3520	0.0819	1.1292	1.3898
		un_ion		0.0745	0.0655	0.0846	0.00798	0.0618	0.0872
100	4	tan	tan	3.5030	3.1300	3.7140	0.2630	3.0846	3.9214
		un_ion		0.1637	0.1358	0.1857	0.0234	0.1264	0.2010
200	4	tan	tan	7.8015	6.7440	8.3130	0.7192	6.6571	8.9459
		un_ion		0.3748	0.2727	0.4472	0.0749	0.2556	0.4941
300	4	tan	tan	10.5018	9.0280	11.5000	1.1241	8.7131	12.2904
		un_ion		0.3621	0.2969	0.4283	0.0682	0.2536	0.4707
400	4	tan	tan	11.6550	11.3040	11.9060	0.2598	11.2416	12.0684
		un_ion		0.3967	0.3581	0.4216	0.0273	0.3533	0.4401

sps=MUC time=6 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0185	0.0170	0.0210	0.00173	0.0157	0.0213
		un_ion		0.00131	0.00122	0.00143	0.000097	0.00115	0.00146
50	4	tan	tan	0.0558	0.0420	0.0800	0.0177	0.0275	0.0840
		un_ion		0.00381	0.00291	0.00542	0.00115	0.00197	0.00565
100	4	tan	tan	0.1055	0.0610	0.2250	0.0799	-0.0217	0.2327
		un_ion		0.00627	0.00399	0.0111	0.00328	0.00106	0.0115

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200	4	tan	tan	0.1070	0.1030	0.1100	0.00316	0.1020	0.1120
		un_ion		0.00670	0.00600	0.00739	0.000578	0.00578	0.00762
300	4	tan	tan	0.1565	0.1380	0.1870	0.0212	0.1228	0.1902
		un_ion		0.00969	0.00883	0.0113	0.00111	0.00792	0.0115
400	4	tan	tan	0.0963	0.0870	0.1050	0.00789	0.0837	0.1088
		un_ion		0.00556	0.00525	0.00574	0.000213	0.00522	0.00590

sps=MUC time=12 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0273	0.0170	0.0510	0.0160	0.00184	0.0527
		un_ion		0.00203	0.00127	0.00374	0.00115	0.000197	0.00386
50	4	tan	tan	0.1420	0.1240	0.1620	0.0172	0.1146	0.1694
		un_ion		0.00764	0.00682	0.00867	0.000766	0.00642	0.00886
100	4	tan	tan	0.5335	0.1410	1.5670	0.6911	-0.5662	1.6332
		un_ion		0.0194	0.00815	0.0454	0.0175	-0.00834	0.0472
200	4	tan	tan	0.3580	0.2850	0.4350	0.0623	0.2588	0.4572
		un_ion		0.0146	0.0126	0.0167	0.00177	0.0118	0.0175
300	4	tan	tan	0.4948	0.3750	0.6000	0.0952	0.3432	0.6463
		un_ion		0.0209	0.0145	0.0269	0.00566	0.0118	0.0299
400	4	tan	tan	0.1533	0.1240	0.2090	0.0392	0.0909	0.2156
		un_ion		0.00469	0.00399	0.00584	0.000804	0.00341	0.00597

sps=MUC time=24 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0120	0.0110	0.0130	0.000816	0.0107	0.0133
		un_ion		0.000753	0.000549	0.000850	0.000138	0.000534	0.000973
50	4	tan	tan	1.3568	1.2660	1.4950	0.1098	1.1820	1.5315
		un_ion		0.0772	0.0638	0.0928	0.0127	0.0570	0.0973
100	4	tan	tan	3.7053	2.4770	4.2120	0.8235	2.3948	5.0157
		un_ion		0.2235	0.1630	0.2530	0.0412	0.1580	0.2890
200	4	tan	tan	8.3040	7.0830	10.1650	1.4709	5.9635	10.6445
		un_ion		0.4101	0.3259	0.5155	0.0983	0.2536	0.5665
300	4	tan	tan	11.4523	9.6960	12.3730	1.2133	9.5216	13.3829
		un_ion		0.4632	0.3815	0.5661	0.0924	0.3163	0.6102
400	4	tan	tan	10.6703	10.2080	11.2370	0.4300	9.9860	11.3545
		un_ion		0.3533	0.3461	0.3706	0.0116	0.3348	0.3718

sps=PPB time=6 form=SDP

								Lower 95%	Upper 95%

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conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	CL for Mean	CL for Mean
0	4	tan	tan	0.0958	0.0860	0.1070	0.00877	0.0818	0.1097
		un_ion		0.00867	0.00753	0.00972	0.000988	0.00710	0.0102
50	4	tan	tan	0.0983	0.0880	0.1150	0.0126	0.0781	0.1184
		un_ion		0.00803	0.00694	0.00981	0.00123	0.00607	0.01000
100	4	tan	tan	0.1225	0.1070	0.1340	0.0132	0.1015	0.1435
		un_ion		0.00948	0.00792	0.0109	0.00132	0.00737	0.0116
200	4	tan	tan	0.1420	0.1040	0.1600	0.0262	0.1002	0.1838
		un_ion		0.0105	0.00686	0.0124	0.00258	0.00637	0.0146
300	4	tan	tan	0.1800	0.1470	0.2000	0.0245	0.1411	0.2189
		un_ion		0.0139	0.0108	0.0177	0.00287	0.00933	0.0185
400	4	tan	tan	0.1508	0.1160	0.1730	0.0246	0.1116	0.1899
		un_ion		0.0112	0.00755	0.0130	0.00253	0.00721	0.0152

sps=PPB time=12 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.1048	0.0930	0.1170	0.00981	0.0891	0.1204
		un_ion		0.00942	0.00820	0.0108	0.00121	0.00750	0.0113
50	4	tan	tan	0.0920	0.0900	0.0960	0.00283	0.0875	0.0965
		un_ion		0.00479	0.00402	0.00549	0.000604	0.00383	0.00575
100	4	tan	tan	0.1023	0.0870	0.1220	0.0146	0.0790	0.1255
		un_ion		0.00482	0.00397	0.00613	0.000965	0.00329	0.00636
200	4	tan	tan	0.1005	0.0850	0.1110	0.0110	0.0829	0.1181
		un_ion		0.00420	0.00339	0.00502	0.000676	0.00312	0.00527
300	4	tan	tan	0.1078	0.0930	0.1200	0.0112	0.0899	0.1256
		un_ion		0.00490	0.00437	0.00561	0.000553	0.00402	0.00578
400	4	tan	tan	0.1210	0.0870	0.1590	0.0297	0.0738	0.1682
		un_ion		0.00519	0.00383	0.00746	0.00162	0.00261	0.00778

sps=PPB time=24 form=SDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0823	0.0540	0.1180	0.0278	0.0380	0.1265
		un_ion		0.00632	0.00426	0.00957	0.00232	0.00263	0.0100
50	4	tan	tan	0.2878	0.1880	0.4010	0.0957	0.1355	0.4400
		un_ion		0.0200	0.0113	0.0284	0.00741	0.00826	0.0318
100	4	tan	tan	0.6630	0.4120	1.1760	0.3482	0.1090	1.2170
		un_ion		0.0378	0.0153	0.0712	0.0237	0.000121	0.0755
200	4	tan	tan	1.0550	0.4180	2.0590	0.7868	-0.1969	2.3069
		un_ion		0.0400	0.0143	0.0823	0.0317	-0.0105	0.0904

300	4	tan un_ion	tan	1.3043 0.0503	0.4930 0.0185	2.1940 0.0870	0.9275 0.0337	-0.1716 -0.00331	2.7801 0.1039
400	4	tan un_ion	tan	1.2853 0.0572	0.4110 0.0144	2.1180 0.1219	0.9599 0.0522	-0.2422 -0.0258	2.8127 0.1403

sps=WAS time=6 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0743 0.00486	0.0650 0.00450	0.0820 0.00533	0.00810 0.000421	0.0614 0.00419	0.0871 0.00553
50	4	tan un_ion	tan	0.1608 0.00908	0.1270 0.00586	0.1940 0.0123	0.0285 0.00302	0.1153 0.00428	0.2062 0.0139
100	4	tan un_ion	tan	0.2158 0.0107	0.1270 0.00503	0.2930 0.0151	0.0734 0.00433	0.0990 0.00378	0.3325 0.0176
200	4	tan un_ion	tan	0.2775 0.0129	0.2320 0.00822	0.3290 0.0151	0.0408 0.00320	0.2125 0.00785	0.3425 0.0180
300	4	tan un_ion	tan	0.3383 0.0144	0.3020 0.0129	0.3740 0.0161	0.0294 0.00140	0.2915 0.0122	0.3850 0.0167
400	4	tan un_ion	tan	0.2485 0.0130	0.2320 0.0114	0.2640 0.0162	0.0132 0.00223	0.2275 0.00941	0.2695 0.0165

sps=WAS time=12 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan un_ion	tan	0.0802 0.00578	0.0710 0.00446	0.0950 0.00744	0.0104 0.00129	0.0637 0.00372	0.0968 0.00783
50	4	tan un_ion	tan	0.3468 0.0186	0.2340 0.00984	0.4440 0.0265	0.0907 0.00846	0.2025 0.00512	0.4910 0.0320
100	4	tan un_ion	tan	0.6490 0.0314	0.4030 0.0150	1.2000 0.0742	0.3739 0.0286	0.0540 -0.0141	1.2440 0.0769
200	4	tan un_ion	tan	1.1965 0.0459	0.5760 0.0203	1.7040 0.0718	0.5161 0.0211	0.3753 0.0124	2.0177 0.0794
300	4	tan un_ion	tan	1.4033 0.0443	1.1690 0.0410	1.8480 0.0470	0.3117 0.00286	0.9073 0.0397	1.8992 0.0488
400	4	tan un_ion	tan	1.4840 0.0497	1.0730 0.0411	1.9250 0.0647	0.3540 0.0104	0.9207 0.0332	2.0473 0.0662

sps=WAS time=24 form=FDP

conc	N Obs	Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
0	4	tan	tan	0.0348	0.0150	0.0530	0.0156	0.00995	0.0596

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		un_ion		0.00228	0.000997	0.00363	0.00108	0.000556	0.00400
50	4	tan	tan	1.3185	0.9800	1.6700	0.3837	0.7079	1.9291
		un_ion		0.0679	0.0389	0.1027	0.0332	0.0150	0.1208
100	4	tan	tan	2.5570	2.3080	2.7440	0.1866	2.2600	2.8540
		un_ion		0.1134	0.0845	0.1592	0.0321	0.0624	0.1645
200	4	tan	tan	5.3930	4.2880	6.7410	1.0189	3.7718	7.0142
		un_ion		0.1927	0.1344	0.2412	0.0545	0.1060	0.2794
300	4	tan	tan	6.8125	5.5930	8.4600	1.3156	4.7191	8.9059
		un_ion		0.1920	0.1635	0.2217	0.0290	0.1460	0.2381
400	4	tan	tan	7.0935	5.4350	9.7190	2.0377	3.8510	10.3360
		un_ion		0.2167	0.1902	0.2347	0.0204	0.1843	0.2492

Performed by K. Weber SAS version 9.4 09:25 07MAY14 KW

AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical analysis of ammonia levels (TAN and un-ionized)
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW KLW

The MEANS Procedure

sps=BLS time=0 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan un_ion	tan	0.0780 0.00606	0.0780 0.00606	0.0780 0.00606	. .	. .	. .

sps=BLS time=6 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan un_ion	tan	0.1053 0.00626	0.0350 0.00253	0.1670 0.00979	0.0481 0.00250	0.0849 0.00520	0.1256 0.00731

sps=BLS time=12 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan un_ion	tan	0.0655 0.00229	0.0350 0.00116	0.1390 0.00504	0.0282 0.000945	0.0536 0.00189	0.0774 0.00269

sps=BLS time=24 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan un_ion	tan	2.4675 0.1055	0.0580 0.00501	5.1530 0.2603	2.0878 0.0883	1.5859 0.0683	3.3491 0.1428

sps=BLS time=25 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan un_ion	tan	0.0525 0.00397	0.0525 0.00397	0.0525 0.00397	. .	. .	. .

sps=FAM time=0 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1820	0.1820	0.1820	.	.	.

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un_ion		0.00576	0.00576	0.00576	.	.	.

sps=FAM time=6 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.4338	0.0770	0.7980	0.2683	0.3205	0.5471
un_ion		0.0243	0.00566	0.0532	0.0142	0.0183	0.0302

sps=FAM time=12 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.3693	0.0490	1.0250	0.3353	0.2277	0.5109
un_ion		0.0120	0.00197	0.0315	0.00858	0.00840	0.0156

sps=FAM time=24 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	2.3000	0.0500	5.1350	1.7151	1.5757	3.0242
un_ion		0.0865	0.00343	0.1971	0.0571	0.0624	0.1106

sps=FAM time=25 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0940	0.0940	0.0940	.	.	.
un_ion		0.00397	0.00397	0.00397	.	.	.

sps=HGE time=0 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0560	0.0560	0.0560	.	.	.
un_ion		0.00358	0.00358	0.00358	.	.	.

sps=HGE time=6 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1307	0.0190	0.2550	0.0757	0.0987	0.1627
un_ion		0.00837	0.00149	0.0155	0.00442	0.00650	0.0102

sps=HGE time=12 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean

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tan	tan	0.1565	0.0130	0.4920	0.1387	0.0980	0.2151
un_ion		0.00506	0.000783	0.0104	0.00331	0.00367	0.00646

sps=HGE time=24 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	1.6212	0.0560	3.9550	1.3468	1.0525	2.1899
un_ion		0.0686	0.00305	0.1725	0.0550	0.0454	0.0919

sps=HGE time=25 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0570	0.0570	0.0570	.	.	.
un_ion		0.00407	0.00407	0.00407	.	.	.

sps=HIC time=0 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0400	0.0400	0.0400	.	.	.
un_ion		0.00347	0.00347	0.00347	.	.	.

sps=HIC time=1 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0615	0.0220	0.1040	0.0338	0.0261	0.0969
un_ion		0.00232	0.00126	0.00332	0.000821	0.00146	0.00318

sps=HIC time=6 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0795	0.0130	0.3050	0.0630	0.0529	0.1060
un_ion		0.00557	0.00108	0.0196	0.00397	0.00390	0.00725

sps=HIC time=12 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1408	0.00800	0.5080	0.1457	0.0793	0.2024
un_ion		0.00538	0.000356	0.0219	0.00511	0.00323	0.00754

sps=HIC time=24 form=FDP

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Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	5.7893	0.0100	11.9060	4.5909	3.8507	7.7279
un_ion		0.2288	0.000717	0.4472	0.1647	0.1593	0.2984

sps=HIC time=25 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1000	0.1000	0.1000	.	.	.
un_ion		0.00685	0.00685	0.00685	.	.	.

sps=MUC time=0 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0800	0.0800	0.0800	.	.	.
un_ion		0.00548	0.00548	0.00548	.	.	.

sps=MUC time=1 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0477	0.0110	0.0830	0.0303	0.0158	0.0795
un_ion		0.00149	0.000520	0.00247	0.000713	0.000739	0.00224

sps=MUC time=6 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0899	0.0170	0.2250	0.0539	0.0672	0.1127
un_ion		0.00556	0.00122	0.0113	0.00296	0.00431	0.00680

sps=MUC time=12 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.2848	0.0170	1.5670	0.3189	0.1501	0.4195
un_ion		0.0115	0.00127	0.0454	0.00994	0.00735	0.0157

sps=MUC time=24 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	5.9168	0.0110	12.3730	4.6226	3.9648	7.8687
un_ion		0.2547	0.000549	0.5661	0.1815	0.1780	0.3313

sps=MUC time=25 form=FDP

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Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0600	0.0600	0.0600	.	.	.
un_ion		0.00429	0.00429	0.00429	.	.	.

sps=PPB time=0 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1080	0.1080	0.1080	.	.	.
un_ion		0.00506	0.00506	0.00506	.	.	.

sps=PPB time=6 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1315	0.0860	0.2000	0.0350	0.1168	0.1463
un_ion		0.0103	0.00686	0.0177	0.00268	0.00916	0.0114

sps=PPB time=12 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.1047	0.0850	0.1590	0.0164	0.0978	0.1116
un_ion		0.00555	0.00339	0.0108	0.00200	0.00471	0.00640

sps=PPB time=24 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.7796	0.0540	2.1940	0.7515	0.4622	1.0969
un_ion		0.0353	0.00426	0.1219	0.0321	0.0217	0.0488

sps=PPB time=25 form=SDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0520	0.0520	0.0520	.	.	.
un_ion		0.00246	0.00246	0.00246	.	.	.

sps=WAS time=0 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0890	0.0890	0.0890	.	.	.

un_ion		0.00515	0.00515	0.00515	.	.	.

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sps=WAS time=6 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.2192	0.0650	0.3740	0.0929	0.1799	0.2584
un_ion		0.0108	0.00450	0.0162	0.00406	0.00911	0.0125

sps=WAS time=12 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.8600	0.0710	1.9250	0.6173	0.5993	1.1206
un_ion		0.0326	0.00446	0.0742	0.0213	0.0236	0.0416

sps=WAS time=24 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	3.8682	0.0150	9.7190	2.9382	2.6275	5.1089
un_ion		0.1308	0.000997	0.2412	0.0839	0.0954	0.1663

sps=WAS time=25 form=FDP

Variable	Label	Mean	Minimum	Maximum	Std Dev	Lower 95% CL for Mean	Upper 95% CL for Mean
tan	tan	0.0250	0.0250	0.0250	.	.	.
un_ion		0.000995	0.000995	0.000995	.	.	.

Performed by K. Weber SAS version 9.4 09:25 07MAY14 KW

FF # 10
Item No. 6
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```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels fr(
title2 h=2 'Statistical analysis of ammonia levels (TAN and un-ionized)';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/************************************************************
* SAS ver 9.4       Analysis prepared by:  KLW klw           *
* Analysis completion date:  07MAY14                         *
************************************************************/
```

AEH-11-PSEUDO-02

```
/*************************************************************************************************
* Variable Names:
* sps = three letter code for mussel species
*           BLS = Black sandshell (Ligumia recta)
*           FAM = Fatmucket (Lampsilis siliquoidea
*           WAS = Washboard (Megalonaias nervosa)
*           HGE = Higgins eye (Lampsilis higginsii)
*           PPB = Plain pocketbook (Lapsilis cardium)
*           HIC = Hickorynut (Obovaria olivaria)
*           MUC = Mucket (Actinonaias ligamentina)
```

FF # 10
Item No. 7
Pg 1 of 2

```
* time = sampling time
*           0 = pre-exposure
*           1 = dosing initiation
*           6, 12, and 24 = 6, 12, and 24 h post dosing initiaiton, respectively
*           25 = ammonia sample from holding period
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
* conc = concentration (in mg/L)
*           0 = control (0 mg/L)
*           50 = 50 mg/L active ingredient
*           100 = 100 mg/L active ingredient
*           200 = 200 mg/L active ingredient
*           300 = 300 mg/L active ingredient
*           400 = 300 mg/L heat deative
* id = exposure chamber ID
*           i.e., 3A5 = test system (1, 2 or 3), Block ID (A or B), and Position in Block (1 - 6)
* temp = temperautre (C) measured during TAN water sample collection
* pH = pH measured during TAN water sample collection
* tan = total ammonia nitrogen levels
*************************************************************************************************

data ammonia; set Pseudo02.ammonia;
un_ion = (1/(10**(0.09018+(2729.92/(273.2+temp))-pH)+1))*tan;
run;
proc sort data=ammonia; by sps time form conc id; run;
proc print data=ammonia; run;

data ammonia_exp; set ammonia;
    if time < 6 then delete;
    if time > 24 then delete;
    run;

/*************************************************************************************
```

```
* This analysis looks at ammonia levels during exposure only. Pre-exposure, exposure    *
* initiation, and holding period samples have been removed from this analysis.          *
****************************************************************************************/
proc means data = ammonia_exp mean min max std clm fw=8;
by sps time form;
class conc;
var tan un_ion;
run;
```

AEH-11-PSEUDO-02

```
/****************************************************************************************
* This analysis looks at ammonia levels at all sampling times.                          *
****************************************************************************************/
proc means data = ammonia mean min max std clm fw=8;
by sps time form;
var tan un_ion;
run;
```

KW
7 MAY 2014

FF # 10
Item No. 7
Pg 2 of 2

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile
mussels from seven different unionid species';
title2 h=2 'Statistical analysis of ammonia levels (TAN and un-ionized)';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/*********************************************************
* SAS ver 9.4      Analysis prepared by:  KLW           *
* Analysis completion date:  07MAY14                    *
*********************************************************/

/*****************************************************************************************
*************
* Variable Names:
            *
* sps = three letter code for mussel species
            *
*           BLS = Black sandshell (Ligumia recta)
            *
*           FAM = Fatmucket (Lampsilis siliquoidea
            *
*           WAS = Washboard (Megalonaias nervosa)
            *
*           HGE = Higgins eye (Lampsilis higginsii)
            *
*           PPB = Plain pocketbook (Lapsilis cardium)
            *
*           HIC = Hickorynut (Obovaria olivaria)
            *
*           MUC = Mucket (Actinonaias ligamentina)
            *
* time = sampling time
            *
*           0 = pre-exposure
            *
*           1 = dosing initiation
            *
*           6, 12, and 24 = 6, 12, and 24 h post dosing initiaiton, respectively
            *
*           25 = ammonia sample from holding period
            *
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
            *
* conc = concentration (in mg/L)
            *
*           0 = control (0 mg/L)
            *
*           50 = 50 mg/L active ingredient
            *
*           100 = 100 mg/L active ingredient
            *
```

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KW

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```
*            200 = 200 mg/L active ingredient
             *
*            300 = 300 mg/L active ingredient
             *
*            400 = 300 mg/L heat deative
             *
* id = exposure chamber ID
             *
*            i.e., 3A5 = test system (1, 2 or 3), Block ID (A or B), and Position in Block (1
 - 6)        *
* temp = temperautre (C) measured during TAN water sample collection
             *
* pH = pH measured during TAN water sample collection
             *
* tan = total ammonia nitrogen levels
             *
*********************************************************************************************
************/

data ammonia; set Pseudo02.ammonia;
un_ion = (1/(10**(0.09018+(2729.92/(273.2+temp))-pH)+1))*tan;
run;

NOTE: There were 530 observations read from the data set PSEUDO02.AMMONIA.
NOTE: The data set WORK.AMMONIA has 530 observations and 9 variables.
NOTE: DATA statement used (Total process time):
      real time           0.02 seconds
      cpu time            0.01 seconds


proc sort data=ammonia; by sps time form conc id; run;

NOTE: There were 530 observations read from the data set WORK.AMMONIA.
NOTE: The data set WORK.AMMONIA has 530 observations and 9 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.01 seconds


proc print data=ammonia; run;
NOTE: Writing HTML Body file: sashtml4.htm

NOTE: There were 530 observations read from the data set WORK.AMMONIA.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.53 seconds
      cpu time            0.42 seconds



data ammonia_exp; set ammonia;
    if time < 6 then delete;
    if time > 24 then delete;
    run;

NOTE: There were 530 observations read from the data set WORK.AMMONIA.
NOTE: The data set WORK.AMMONIA_EXP has 504 observations and 9 variables.
```

```
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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```

/*****************************************************************************************
* This analysis looks at ammonia levels during exposure only. Pre-exposure, exposure     *
* initiation, and holding period samples have been removed from this analysis.           *
*****************************************************************************************/
proc means data = ammonia_exp mean min max std clm fw=8;
by sps time form;
class conc;
var tan un_ion;
run;

NOTE: There were 504 observations read from the data set WORK.AMMONIA_EXP.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.30 seconds
      cpu time            0.26 seconds


/*****************************************************************************************
* This analysis looks at ammonia levels at all sampling times.                            *
*****************************************************************************************/
proc means data = ammonia mean min max std clm fw=8;
by sps time form;
var tan un_ion;
run;

NOTE: There were 530 observations read from the data set WORK.AMMONIA.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.16 seconds
      cpu time            0.14 seconds
```

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Study Number: AEH-11-PSEUDO-02		Action	Date	Initials
Data Source:	File Folders: 10f, 10g	Created......	1-May-14	KLW KLW
	Water Quality Forms: 4 and 5	Revised......	19-Nov-14	KLW KLW
		Reviewed...	19 Nov 14	KLW
		Certified...		
File Name:	I:\AEH-11-PSEUDO-02\Data\[PSEUDO-02 Water Chem for SAS.xlsx]Holding Water Chem			

Holding Period Water Chemistry

Species, Dosing, and Assessment Information

Scientific Name	Common Name	Abbreviation	Formulation Type	Test Article Lot Number	Exposure Date	Assessment Date
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	12-Jul-11	20-Jul-11
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	14-Jul-11	22-Jul-11
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	13-Dec-11	21-Dec-11
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	27-Jan-12	4-Feb-12
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	17-Apr-12	25-Apr-12
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	16-May-12	24-May-12
Lampsilis higginsii	Higgins eye	HGE	SDP	TR4669-4-(5)	26-May-12	3-Jun-12

Data codes used within SAS

sps = Juvenile mussel species (see 3 letter abbreviation codes above)
day = Day post-exposure during 7 day holding period
form = Product formulation
FDP = Freeze dried powder
SDP = Spray dried powder
id = Exposure chamber ID
i.e., 1A2 = Test system (1, 2, or 3), Block ID (A or B), and Position in Block (1-12)
do = Dissolved oxygen (in mg/L)
temp = Temperature (in ° C)
pH = pH
hard = Water hardness (in mg/L of $CaCO_3$)
alk = Alkalinity (in mg/L of CaCO3)
con = Conductivity (in µS/cm temperature compensated to 25°C)

Data Explanation

Water chemistry data analyses were limited to simple descriptive statistics (Proc Means) using SAS Version 9.4.

Data Anomalies and Deviations

NONE

File Folder 10
Item Number 4
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sps	day	form	id	do	temp	ph	hard	alk	con
HIC	0	FDP	1A7	8.27	19.6	8.29	178	129	386
HIC	0	FDP	1B7	8.22	19.6	8.20	.	.	.
HIC	1	FDP	1A8	8.21	19.7	8.24	.	.	.
HIC	1	FDP	1B8	8.07	19.6	8.24	.	.	.
HIC	2	FDP	1A9	8.09	19.7	8.07	.	.	.
HIC	2	FDP	1B9	7.95	19.6	8.27	.	.	.
HIC	3	FDP	1A10	8.11	19.7	8.24	.	.	.
HIC	3	FDP	1B10	7.72	19.6	8.27	.	.	.
HIC	4	FDP	1A11	7.88	19.7	8.23	.	.	.
HIC	4	FDP	1B11	7.99	19.6	8.26	.	.	.
HIC	5	FDP	1A12	7.86	19.9	8.26	.	.	.
HIC	5	FDP	1B12	7.73	19.9	8.25	.	.	.
HIC	6	FDP	1A1	7.92	19.7	8.16	.	.	.
HIC	6	FDP	1B1	7.28	19.6	8.15	.	.	.
HIC	7	FDP	1A2	7.55	19.5	8.15	.	.	.
HIC	7	FDP	1B2	8.03	19.3	8.19	.	.	.
MUC	0	FDP	2A9	7.91	19.7	8.24	178	131	390
MUC	1	FDP	2A10	7.92	19.6	8.29	.	.	.
MUC	2	FDP	2A11	8.24	19.6	8.29	.	.	.
MUC	3	FDP	2A12	8.28	19.9	8.30	.	.	.
MUC	4	FDP	2A1	7.70	20.1	8.15	.	.	.
MUC	5	FDP	2A2	7.90	19.8	8.23	.	.	.
MUC	6	FDP	2A3	7.79	19.9	8.26	.	.	.
MUC	7	FDP	2A4	7.55	20.1	8.20	.	.	.
MUC	0	FDP	2B9	8.31	19.6	8.29	.	.	.
MUC	1	FDP	2B10	8.27	19.8	8.31	.	.	.
MUC	2	FDP	2B11	7.86	19.6	8.18	.	.	.
MUC	3	FDP	2B12	8.10	19.8	8.26	.	.	.
MUC	4	FDP	2B1	7.68	19.9	8.19	.	.	.
MUC	5	FDP	2B2	7.80	19.7	8.22	.	.	.
MUC	6	FDP	2B3	7.83	19.8	8.23	.	.	.
MUC	7	FDP	2B4	7.77	19.9	8.20	.	.	.
WAS	0	FDP	2A1	8.06	20.1	8.06	178	121	402
WAS	0	FDP	2A2	8.01	20.0	8.09	.	.	.
WAS	0	FDP	2A3	7.81	19.9	8.10	.	.	.
WAS	0	FDP	2A4	7.94	19.8	8.06	.	.	.
WAS	0	FDP	2A5	7.76	19.7	8.05	.	.	.
WAS	0	FDP	2A6	8.07	19.7	8.09	.	.	.
WAS	0	FDP	2A7	7.80	19.6	8.06	.	.	.
WAS	0	FDP	2A8	7.88	19.6	8.07	.	.	.
WAS	0	FDP	2A9	8.38	19.6	8.17	.	.	.
WAS	0	FDP	2A10	7.86	19.6	8.08	.	.	.
WAS	0	FDP	2A11	8.33	19.5	8.16	.	.	.
WAS	0	FDP	2A12	8.06	19.5	8.11	.	.	.
WAS	0	FDP	2B1	8.54	19.8	8.14	.	.	.
WAS	0	FDP	2B2	8.35	19.7	8.12	.	.	.

WAS	0	FDP	2B3	8.22	19.6	8.11	.	.	.
WAS	0	FDP	2B4	8.05	19.7	8.09	.	.	.
WAS	0	FDP	2B5	8.05	19.7	8.11	.	.	.
WAS	0	FDP	2B6	8.11	19.8	8.10	.	.	.
WAS	0	FDP	2B7	8.42	19.8	8.17	.	.	.
WAS	0	FDP	2B8	7.97	19.9	8.11	.	.	.
WAS	0	FDP	2B9	8.34	19.7	8.12	.	.	.
WAS	0	FDP	2B10	8.26	19.7	8.17	.	.	.
WAS	0	FDP	2B11	8.30	19.9	8.13	.	.	.
WAS	0	FDP	2B12	8.18	20.1	8.12	.	.	.
WAS	1	FDP	2A5	8.03	20.6	8.11	.	.	.
WAS	2	FDP	2A6	8.36	20.7	8.22	.	.	.
WAS	3	FDP	2A7	8.41	20.7	8.16	.	.	.
WAS	4	FDP	2A8	8.45	20.7	8.09	.	.	.
WAS	5	FDP	2A9	8.14	20.7	8.21	.	.	.
WAS	6	FDP	2A10	8.14	18.7	8.08	.	.	.
WAS	7	FDP	2A11	8.66	19.3	8.27	.	.	.
WAS	1	FDP	2B5	8.19	20.4	8.13	.	.	.
WAS	2	FDP	2B6	8.23	20.3	8.09	.	.	.
WAS	3	FDP	2B7	8.22	20.4	8.14	.	.	.
WAS	4	FDP	2B8	8.53	20.5	8.14	.	.	.
WAS	5	FDP	2B9	8.08	20.5	8.14	.	.	.
WAS	6	FDP	2B10	8.78	18.9	8.20	.	.	.
WAS	7	FDP	2B11	8.29	19.5	8.30	.	.	.
FAM	0	SDP	1A8	7.64	20.0	7.87	175	123	383
FAM	1	SDP	1A9	8.36	20.2	7.89	.	.	.
FAM	2	SDP	1A10	8.37	20.1	7.85	.	.	.
FAM	3	SDP	1A11	8.19	20.5	7.98	.	.	.
FAM	4	SDP	1A12	8.07	20.4	8.08	.	.	.
FAM	5	SDP	1A1	8.07	20.5	8.11	.	.	.
FAM	6	SDP	1A2	7.96	20.6	8.14	.	.	.
FAM	7	SDP	1A3	7.83	20.4	7.91	.	.	.
FAM	0	SDP	1B8	7.45	20.0	7.88	.	.	.
FAM	1	SDP	1B9	8.28	20.1	8.01	.	.	.
FAM	2	SDP	1B10	8.72	20.0	7.97	.	.	.
FAM	3	SDP	1B11	8.13	20.5	8.01	.	.	.
FAM	4	SDP	1B12	8.25	20.5	8.13	.	.	.
FAM	5	SDP	1B1	8.05	20.4	8.11	.	.	.
FAM	6	SDP	1B2	7.96	20.4	8.15	.	.	.
FAM	7	SDP	1B3	8.03	20.3	8.05	.	.	.
BLS	0	SDP	2A10	8.55	19.9	8.19	176	121	378
BLS	1	SDP	2A11	8.37	19.9	8.23	.	.	.
BLS	2	SDP	2A12	8.53	19.8	7.88	.	.	.
BLS	3	SDP	2A1	8.25	20.5	8.21	.	.	.
BLS	4	SDP	2A2	8.32	20.2	8.24	.	.	.
BLS	5	SDP	2A3	8.51	20.2	8.24	.	.	.
BLS	6	SDP	2A4	8.04	20.2	8.27	.	.	.

BLS	7	SDP	2A5	8.34	20.1	8.21	.	.	.
BLS	0	SDP	2B1	8.47	19.9	8.18	.	.	.
BLS	1	SDP	2B2	8.38	20.0	8.26	.	.	.
BLS	2	SDP	2B3	8.45	19.9	7.90	.	.	.
BLS	3	SDP	2B4	8.30	20.0	8.26	.	.	.
BLS	4	SDP	2B5	8.61	19.9	8.28	.	.	.
BLS	5	SDP	2B6	8.32	20.0	8.27	.	.	.
BLS	6	SDP	2B7	8.59	20.1	8.30	.	.	.
BLS	7	SDP	2B8	8.54	20.1	8.27	.	.	.
PPB	0	SDP	1A10	8.34	20.3	7.92	174	126	364
PPB	1	SDP	1A11	8.21	20.6	8.11	.	.	.
PPB	2	SDP	1A12	8.18	20.5	8.06	.	.	.
PPB	3	SDP	1A1	8.30	20.5	8.14	.	.	.
PPB	4	SDP	1A2	8.98	20.4	8.05	.	.	.
PPB	5	SDP	1A3	8.19	20.4	8.28	.	.	.
PPB	6	SDP	1A4	8.21	20.2	8.18	.	.	.
PPB	7	SDP	1A5	8.15	20.5	8.31	.	.	.
PPB	0	SDP	1B10	8.46	20.3	8.02	.	.	.
PPB	1	SDP	1B11	7.93	20.6	8.03	.	.	.
PPB	2	SDP	1B12	8.16	20.6	8.09	.	.	.
PPB	3	SDP	1B1	8.06	20.4	8.16	.	.	.
PPB	4	SDP	1B12	8.65	20.1	8.08	.	.	.
PPB	5	SDP	1B3	8.46	20.2	8.21	.	.	.
PPB	6	SDP	1B4	8.23	20.0	8.10	.	.	.
PPB	7	SDP	1B5	8.04	20.4	8.25	.	.	.
HGE	0	SDP	1A9	7.84	20.6	7.98	178	121	363
HGE	1	SDP	1A10	7.79	20.6	8.20	.	.	.
HGE	2	SDP	1A12	8.35	20.2	8.18	.	.	.
HGE	3	SDP	1A1	8.60	20.3	8.31	.	.	.
HGE	4	SDP	1A2	8.33	20.5	8.17	.	.	.
HGE	5	SDP	1A3	7.76	20.5	8.16	.	.	.
HGE	6	SDP	1A4	8.04	20.6	8.21	.	.	.
HGE	7	SDP	1A5	8.20	20.6	8.16	.	.	.
HGE	0	SDP	1B9	7.97	20.2	8.10	.	.	.
HGE	1	SDP	1B10	8.01	20.5	8.20	.	.	.
HGE	2	SDP	1B12	8.20	20.3	8.22	.	.	.
HGE	3	SDP	1B1	8.59	20.1	8.30	.	.	.
HGE	4	SDP	1B2	8.57	20.3	8.26	.	.	.
HGE	5	SDP	1B3	7.95	20.3	8.24	.	.	.
HGE	6	SDP	1B4	8.22	20.5	8.24	.	.	.
HGE	7	SDP	1B5	8.11	20.5	8.22	.	.	.

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Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical analysis of holding period water chemistry
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW klw

Obs	sps	day	form	id	do	temp	ph	hard	alk	con
1	HIC	0	FDP	1A7	8.27	19.6	8.29	178	129	386
2	HIC	0	FDP	1B7	8.22	19.6	8.20	.	.	.
3	HIC	1	FDP	1A8	8.21	19.7	8.24	.	.	.
4	HIC	1	FDP	1B8	8.07	19.6	8.24	.	.	.
5	HIC	2	FDP	1A9	8.09	19.7	8.07	.	.	.
6	HIC	2	FDP	1B9	7.95	19.6	8.27	.	.	.
7	HIC	3	FDP	1A10	8.11	19.7	8.24	.	.	.
8	HIC	3	FDP	1B10	7.72	19.6	8.27	.	.	.
9	HIC	4	FDP	1A11	7.88	19.7	8.23	.	.	.
10	HIC	4	FDP	1B11	7.99	19.6	8.26	.	.	.
11	HIC	5	FDP	1A12	7.86	19.9	8.26	.	.	.
12	HIC	5	FDP	1B12	7.73	19.9	8.25	.	.	.
13	HIC	6	FDP	1A1	7.92	19.7	8.16	.	.	.
14	HIC	6	FDP	1B1	7.28	19.6	8.15	.	.	.
15	HIC	7	FDP	1A2	7.55	19.5	8.15	.	.	.
16	HIC	7	FDP	1B2	8.03	19.3	8.19	.	.	.
17	MUC	0	FDP	2A9	7.91	19.7	8.24	178	131	390
18	MUC	0	FDP	2B9	8.31	19.6	8.29	.	.	.
19	MUC	1	FDP	2A10	7.92	19.6	8.29	.	.	.
20	MUC	1	FDP	2B10	8.27	19.8	8.31	.	.	.
21	MUC	2	FDP	2A11	8.24	19.6	8.29	.	.	.
22	MUC	2	FDP	2B11	7.86	19.6	8.18	.	.	.
23	MUC	3	FDP	2A12	8.28	19.9	8.30	.	.	.
24	MUC	3	FDP	2B12	8.10	19.8	8.26	.	.	.
25	MUC	4	FDP	2A1	7.70	20.1	8.15	.	.	.
26	MUC	4	FDP	2B1	7.68	19.9	8.19	.	.	.
27	MUC	5	FDP	2A2	7.90	19.8	8.23	.	.	.
28	MUC	5	FDP	2B2	7.80	19.7	8.22	.	.	.
29	MUC	6	FDP	2A3	7.79	19.9	8.26	.	.	.
30	MUC	6	FDP	2B3	7.83	19.8	8.23	.	.	.

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31	MUC	7	FDP	2A4	7.55	20.1	8.20	.	.	.
32	MUC	7	FDP	2B4	7.77	19.9	8.20	.	.	.
33	WAS	0	FDP	2A1	8.06	20.1	8.06	178	121	402
34	WAS	0	FDP	2A10	7.86	19.6	8.08	.	.	.
35	WAS	0	FDP	2A11	8.33	19.5	8.16	.	.	.
36	WAS	0	FDP	2A12	8.06	19.5	8.11	.	.	.
37	WAS	0	FDP	2A2	8.01	20.0	8.09	.	.	.
38	WAS	0	FDP	2A3	7.81	19.9	8.10	.	.	.
39	WAS	0	FDP	2A4	7.94	19.8	8.06	.	.	.
40	WAS	0	FDP	2A5	7.76	19.7	8.05	.	.	.
41	WAS	0	FDP	2A6	8.07	19.7	8.09	.	.	.
42	WAS	0	FDP	2A7	7.80	19.6	8.06	.	.	.
43	WAS	0	FDP	2A8	7.88	19.6	8.07	.	.	.
44	WAS	0	FDP	2A9	8.38	19.6	8.17	.	.	.
45	WAS	0	FDP	2B1	8.54	19.8	8.14	.	.	.
46	WAS	0	FDP	2B10	8.26	19.7	8.17	.	.	.
47	WAS	0	FDP	2B11	8.30	19.9	8.13	.	.	.
48	WAS	0	FDP	2B12	8.18	20.1	8.12	.	.	.
49	WAS	0	FDP	2B2	8.35	19.7	8.12	.	.	.
50	WAS	0	FDP	2B3	8.22	19.6	8.11	.	.	.
51	WAS	0	FDP	2B4	8.05	19.7	8.09	.	.	.
52	WAS	0	FDP	2B5	8.05	19.7	8.11	.	.	.
53	WAS	0	FDP	2B6	8.11	19.8	8.10	.	.	.
54	WAS	0	FDP	2B7	8.42	19.8	8.17	.	.	.
55	WAS	0	FDP	2B8	7.97	19.9	8.11	.	.	.
56	WAS	0	FDP	2B9	8.34	19.7	8.12	.	.	.
57	WAS	1	FDP	2A5	8.03	20.6	8.11	.	.	.
58	WAS	1	FDP	2B5	8.19	20.4	8.13	.	.	.
59	WAS	2	FDP	2A6	8.36	20.7	8.22	.	.	.
60	WAS	2	FDP	2B6	8.23	20.3	8.09	.	.	.
61	WAS	3	FDP	2A7	8.41	20.7	8.16	.	.	.
62	WAS	3	FDP	2B7	8.22	20.4	8.14	.	.	.
63	WAS	4	FDP	2A8	8.45	20.7	8.09	.	.	.
64	WAS	4	FDP	2B8	8.53	20.5	8.14	.	.	.
65	WAS	5	FDP	2A9	8.14	20.7	8.21	.	.	.

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	WAS	5	FDP	2B9	8.08	20.5	8.14	.	.	.
67	WAS	6	FDP	2A10	8.14	18.7	8.08	.	.	.
68	WAS	6	FDP	2B10	8.78	18.9	8.20	.	.	.
69	WAS	7	FDP	2A11	8.66	19.3	8.27	.	.	.
70	WAS	7	FDP	2B11	8.29	19.5	8.30	.	.	.
71	BLS	0	SDP	2A10	8.55	19.9	8.19	176	121	378
72	BLS	0	SDP	2B1	8.47	19.9	8.18	.	.	.
73	BLS	1	SDP	2A11	8.37	19.9	8.23	.	.	.
74	BLS	1	SDP	2B2	8.38	20.0	8.26	.	.	.
75	BLS	2	SDP	2A12	8.53	19.8	7.88	.	.	.
76	BLS	2	SDP	2B3	8.45	19.9	7.90	.	.	.
77	BLS	3	SDP	2A1	8.25	20.5	8.21	.	.	.
78	BLS	3	SDP	2B4	8.30	20.0	8.26	.	.	.
79	BLS	4	SDP	2A2	8.32	20.2	8.24	.	.	.
80	BLS	4	SDP	2B5	8.61	19.9	8.28	.	.	.
81	BLS	5	SDP	2A3	8.51	20.2	8.24	.	.	.
82	BLS	5	SDP	2B6	8.32	20.0	8.27	.	.	.
83	BLS	6	SDP	2A4	8.04	20.2	8.27	.	.	.
84	BLS	6	SDP	2B7	8.59	20.1	8.30	.	.	.
85	BLS	7	SDP	2A5	8.34	20.1	8.21	.	.	.
86	BLS	7	SDP	2B8	8.54	20.1	8.27	.	.	.
87	FAM	0	SDP	1A8	7.64	20.0	7.87	175	123	383
88	FAM	0	SDP	1B8	7.45	20.0	7.88	.	.	.
89	FAM	1	SDP	1A9	8.36	20.2	7.89	.	.	.
90	FAM	1	SDP	1B9	8.28	20.1	8.01	.	.	.
91	FAM	2	SDP	1A10	8.37	20.1	7.85	.	.	.
92	FAM	2	SDP	1B10	8.72	20.0	7.97	.	.	.
93	FAM	3	SDP	1A11	8.19	20.5	7.98	.	.	.
94	FAM	3	SDP	1B11	8.13	20.5	8.01	.	.	.
95	FAM	4	SDP	1A12	8.07	20.4	8.08	.	.	.
96	FAM	4	SDP	1B12	8.25	20.5	8.13	.	.	.
97	FAM	5	SDP	1A1	8.07	20.5	8.11	.	.	.
98	FAM	5	SDP	1B1	8.05	20.4	8.11	.	.	.
99	FAM	6	SDP	1A2	7.96	20.6	8.14	.	.	.
100	FAM	6	SDP	1B2	7.96	20.4	8.15	.	.	.

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	FAM	7	SDP	1A3	7.83	20.4	7.91	.	.	.
102	FAM	7	SDP	1B3	8.03	20.3	8.05	.	.	.
103	HGE	0	SDP	1A9	7.84	20.6	7.98	178	121	363
104	HGE	0	SDP	1B9	7.97	20.2	8.10	.	.	.
105	HGE	1	SDP	1A10	7.79	20.6	8.20	.	.	.
106	HGE	1	SDP	1B10	8.01	20.5	8.20	.	.	.
107	HGE	2	SDP	1A12	8.35	20.2	8.18	.	.	.
108	HGE	2	SDP	1B12	8.20	20.3	8.22	.	.	.
109	HGE	3	SDP	1A1	8.60	20.3	8.31	.	.	.
110	HGE	3	SDP	1B1	8.59	20.1	8.30	.	.	.
111	HGE	4	SDP	1A2	8.33	20.5	8.17	.	.	.
112	HGE	4	SDP	1B2	8.57	20.3	8.26	.	.	.
113	HGE	5	SDP	1A3	7.76	20.5	8.16	.	.	.
114	HGE	5	SDP	1B3	7.95	20.3	8.24	.	.	.
115	HGE	6	SDP	1A4	8.04	20.6	8.21	.	.	.
116	HGE	6	SDP	1B4	8.22	20.5	8.24	.	.	.
117	HGE	7	SDP	1A5	8.20	20.6	8.16	.	.	.
118	HGE	7	SDP	1B5	8.11	20.5	8.22	.	.	.
119	PPB	0	SDP	1A10	8.34	20.3	7.92	174	126	364
120	PPB	0	SDP	1B10	8.46	20.3	8.02	.	.	.
121	PPB	1	SDP	1A11	8.21	20.6	8.11	.	.	.
122	PPB	1	SDP	1B11	7.93	20.6	8.03	.	.	.
123	PPB	2	SDP	1A12	8.18	20.5	8.06	.	.	.
124	PPB	2	SDP	1B12	8.16	20.6	8.09	.	.	.
125	PPB	3	SDP	1A1	8.30	20.5	8.14	.	.	.
126	PPB	3	SDP	1B1	8.06	20.4	8.16	.	.	.
127	PPB	4	SDP	1A2	8.98	20.4	8.05	.	.	.
128	PPB	4	SDP	1B12	8.65	20.1	8.08	.	.	.
129	PPB	5	SDP	1A3	8.19	20.4	8.28	.	.	.
130	PPB	5	SDP	1B3	8.46	20.2	8.21	.	.	.
131	PPB	6	SDP	1A4	8.21	20.2	8.18	.	.	.
132	PPB	6	SDP	1B4	8.23	20.0	8.10	.	.	.
133	PPB	7	SDP	1A5	8.15	20.5	8.31	.	.	.
134	PPB	7	SDP	1B5	8.04	20.4	8.25	.	.	.

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Performed by K. Weber SAS version 9.4 10:07 07MAY14 KW

AEH-11-PSEUDO-02

Analyzes dissolved oxygen, temperature and pH only

The MEANS Procedure

AEH-11-PSEUDO-02

form=FDP

sps	day	N Obs	Variable	Label	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
HIC	0	2	do	do	8.2450	0.0354	8.2200	8.2700	7.9273	8.5627
			temp	temp	19.6000	0	19.6000	19.6000	.	.
			ph	ph	8.2450	0.0636	8.2000	8.2900	7.6732	8.8168
	1	2	do	do	8.1400	0.0990	8.0700	8.2100	7.2506	9.0294
			temp	temp	19.6500	0.0707	19.6000	19.7000	19.0147	20.2853
			ph	ph	8.2400	0	8.2400	8.2400	.	.
	2	2	do	do	8.0200	0.0990	7.9500	8.0900	7.1306	8.9094
			temp	temp	19.6500	0.0707	19.6000	19.7000	19.0147	20.2853
			ph	ph	8.1700	0.1414	8.0700	8.2700	6.8994	9.4406
	3	2	do	do	7.9150	0.2758	7.7200	8.1100	5.4373	10.3927
			temp	temp	19.6500	0.0707	19.6000	19.7000	19.0147	20.2853
			ph	ph	8.2550	0.0212	8.2400	8.2700	8.0644	8.4456
	4	2	do	do	7.9350	0.0778	7.8800	7.9900	7.2362	8.6338
			temp	temp	19.6500	0.0707	19.6000	19.7000	19.0147	20.2853
			ph	ph	8.2450	0.0212	8.2300	8.2600	8.0544	8.4356
	5	2	do	do	7.7950	0.0919	7.7300	7.8600	6.9691	8.6209
			temp	temp	19.9000	0	19.9000	19.9000	.	.
			ph	ph	8.2550	0.00707	8.2500	8.2600	8.1915	8.3185
	6	2	do	do	7.6000	0.4525	7.2800	7.9200	3.5340	11.6660
			temp	temp	19.6500	0.0707	19.6000	19.7000	19.0147	20.2853
			ph	ph	8.1550	0.00707	8.1500	8.1600	8.0915	8.2185
	7	2	do	do	7.7900	0.3394	7.5500	8.0300	4.7405	10.8395
			temp	temp	19.4000	0.1414	19.3000	19.5000	18.1294	20.6706
			ph	ph	8.1700	0.0283	8.1500	8.1900	7.9159	8.4241
MUC	0	2	do	do	8.1100	0.2828	7.9100	8.3100	5.5688	10.6512
			temp	temp	19.6500	0.0707	19.6000	19.7000	19.0147	20.2853
			ph	ph	8.2650	0.0354	8.2400	8.2900	7.9473	8.5827
	1	2	do	do	8.0950	0.2475	7.9200	8.2700	5.8714	10.3186
			temp	temp	19.7000	0.1414	19.6000	19.8000	18.4294	20.9706
			ph	ph	8.3000	0.0141	8.2900	8.3100	8.1729	8.4271
	2	2	do	do	8.0500	0.2687	7.8600	8.2400	5.6358	10.4642
			temp	temp	19.6000	0	19.6000	19.6000	.	.
			ph	ph	8.2350	0.0778	8.1800	8.2900	7.5362	8.9338
	3	2	do	do	8.1900	0.1273	8.1000	8.2800	7.0464	9.3336
			temp	temp	19.8500	0.0707	19.8000	19.9000	19.2147	20.4853
			ph	ph	8.2800	0.0283	8.2600	8.3000	8.0259	8.5341
			do	do	7.6900	0.0141	7.6800	7.7000	7.5629	7.8171

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	4	2	temp ph	temp ph	20.0000 8.1700	0.1414 0.0283	19.9000 8.1500	20.1000 8.1900	18.7294 7.9159	21.2706 8.4241
	5	2	do temp ph	do temp ph	7.8500 19.7500 8.2250	0.0707 0.0707 0.00707	7.8000 19.7000 8.2200	7.9000 19.8000 8.2300	7.2147 19.1147 8.1615	8.4853 20.3853 8.2885
	6	2	do temp ph	do temp ph	7.8100 19.8500 8.2450	0.0283 0.0707 0.0212	7.7900 19.8000 8.2300	7.8300 19.9000 8.2600	7.5559 19.2147 8.0544	8.0641 20.4853 8.4356
	7	2	do temp ph	do temp ph	7.6600 20.0000 8.2000	0.1556 0.1414 0	7.5500 19.9000 8.2000	7.7700 20.1000 8.2000	6.2623 18.7294 .	9.0577 21.2706 .
WAS	0	24	do temp ph	do temp ph	8.1146 19.7500 8.1079	0.2171 0.1668 0.0360	7.7600 19.5000 8.0500	8.5400 20.1000 8.1700	8.0229 19.6796 8.0927	8.2063 19.8204 8.1231
	1	2	do temp ph	do temp ph	8.1100 20.5000 8.1200	0.1131 0.1414 0.0141	8.0300 20.4000 8.1100	8.1900 20.6000 8.1300	7.0935 19.2294 7.9929	9.1265 21.7706 8.2471
	2	2	do temp ph	do temp ph	8.2950 20.5000 8.1550	0.0919 0.2828 0.0919	8.2300 20.3000 8.0900	8.3600 20.7000 8.2200	7.4691 17.9588 7.3291	9.1209 23.0412 8.9809
	3	2	do temp ph	do temp ph	8.3150 20.5500 8.1500	0.1344 0.2121 0.0141	8.2200 20.4000 8.1400	8.4100 20.7000 8.1600	7.1079 18.6441 8.0229	9.5221 22.4559 8.2771
	4	2	do temp ph	do temp ph	8.4900 20.6000 8.1150	0.0566 0.1414 0.0354	8.4500 20.5000 8.0900	8.5300 20.7000 8.1400	7.9818 19.3294 7.7973	8.9982 21.8706 8.4327
	5	2	do temp ph	do temp ph	8.1100 20.6000 8.1750	0.0424 0.1414 0.0495	8.0800 20.5000 8.1400	8.1400 20.7000 8.2100	7.7288 19.3294 7.7303	8.4912 21.8706 8.6197
	6	2	do temp ph	do temp ph	8.4600 18.8000 8.1400	0.4525 0.1414 0.0849	8.1400 18.7000 8.0800	8.7800 18.9000 8.2000	4.3940 17.5294 7.3776	12.5260 20.0706 8.9024
	7	2	do temp ph	do temp ph	8.4750 19.4000 8.2850	0.2616 0.1414 0.0212	8.2900 19.3000 8.2700	8.6600 19.5000 8.3000	6.1244 18.1294 8.0944	10.8256 20.6706 8.4756

form=SDP

sps	day	N Obs	Variable	Label	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
BLS	0	2	do temp ph	do temp ph	8.5100 19.9000 8.1850	0.0566 0 0.00707	8.4700 19.9000 8.1800	8.5500 19.9000 8.1900	8.0018 . 8.1215	9.0182 . 8.2485
	1	2	do temp	do temp	8.3750 19.9500	0.00707 0.0707	8.3700 19.9000	8.3800 20.0000	8.3115 19.3147	8.4385 20.5853

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			ph	ph	8.2450	0.0212	8.2300	8.2600	8.0544	8.4356
	2	2	do temp ph	do temp ph	8.4900 19.8500 7.8900	0.0566 0.0707 0.0141	8.4500 19.8000 7.8800	8.5300 19.9000 7.9000	7.9818 19.2147 7.7629	8.9982 20.4853 8.0171
	3	2	do temp ph	do temp ph	8.2750 20.2500 8.2350	0.0354 0.3536 0.0354	8.2500 20.0000 8.2100	8.3000 20.5000 8.2600	7.9573 17.0734 7.9173	8.5927 23.4266 8.5527
	4	2	do temp ph	do temp ph	8.4650 20.0500 8.2600	0.2051 0.2121 0.0283	8.3200 19.9000 8.2400	8.6100 20.2000 8.2800	6.6226 18.1441 8.0059	10.3074 21.9559 8.5141
	5	2	do temp ph	do temp ph	8.4150 20.1000 8.2550	0.1344 0.1414 0.0212	8.3200 20.0000 8.2400	8.5100 20.2000 8.2700	7.2079 18.8294 8.0644	9.6221 21.3706 8.4456
	6	2	do temp ph	do temp ph	8.3150 20.1500 8.2850	0.3889 0.0707 0.0212	8.0400 20.1000 8.2700	8.5900 20.2000 8.3000	4.8208 19.5147 8.0944	11.8092 20.7853 8.4756
	7	2	do temp ph	do temp ph	8.4400 20.1000 8.2400	0.1414 0 0.0424	8.3400 20.1000 8.2100	8.5400 20.1000 8.2700	7.1694 . 7.8588	9.7106 . 8.6212
FAM	0	2	do temp ph	do temp ph	7.5450 20.0000 7.8750	0.1344 0 0.00707	7.4500 20.0000 7.8700	7.6400 20.0000 7.8800	6.3379 . 7.8115	8.7521 . 7.9385
	1	2	do temp ph	do temp ph	8.3200 20.1500 7.9500	0.0566 0.0707 0.0849	8.2800 20.1000 7.8900	8.3600 20.2000 8.0100	7.8118 19.5147 7.1876	8.8282 20.7853 8.7124
	2	2	do temp ph	do temp ph	8.5450 20.0500 7.9100	0.2475 0.0707 0.0849	8.3700 20.0000 7.8500	8.7200 20.1000 7.9700	6.3214 19.4147 7.1476	10.7686 20.6853 8.6724
	3	2	do temp ph	do temp ph	8.1600 20.5000 7.9950	0.0424 0 0.0212	8.1300 20.5000 7.9800	8.1900 20.5000 8.0100	7.7788 . 7.8044	8.5412 . 8.1856
	4	2	do temp ph	do temp ph	8.1600 20.4500 8.1050	0.1273 0.0707 0.0354	8.0700 20.4000 8.0800	8.2500 20.5000 8.1300	7.0164 19.8147 7.7873	9.3036 21.0853 8.4227
	5	2	do temp ph	do temp ph	8.0600 20.4500 8.1100	0.0141 0.0707 0	8.0500 20.4000 8.1100	8.0700 20.5000 8.1100	7.9329 19.8147 .	8.1871 21.0853 .
	6	2	do temp ph	do temp ph	7.9600 20.5000 8.1450	0 0.1414 0.00707	7.9600 20.4000 8.1400	7.9600 20.6000 8.1500	. 19.2294 8.0815	. 21.7706 8.2085
	7	2	do temp ph	do temp ph	7.9300 20.3500 7.9800	0.1414 0.0707 0.0990	7.8300 20.3000 7.9100	8.0300 20.4000 8.0500	6.6594 19.7147 7.0906	9.2006 20.9853 8.8694
HGE	0	2	do temp	do temp	7.9050 20.4000	0.0919 0.2828	7.8400 20.2000	7.9700 20.6000	7.0791 17.8588	8.7309 22.9412

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			ph	ph	8.0400	0.0849	7.9800	8.1000	7.2776	8.8024
	1	2	do	do	7.9000	0.1556	7.7900	8.0100	6.5023	9.2977
			temp	temp	20.5500	0.0707	20.5000	20.6000	19.9147	21.1853
			ph	ph	8.2000	0	8.2000	8.2000	.	.
	2	2	do	do	8.2750	0.1061	8.2000	8.3500	7.3220	9.2280
			temp	temp	20.2500	0.0707	20.2000	20.3000	19.6147	20.8853
			ph	ph	8.2000	0.0283	8.1800	8.2200	7.9459	8.4541
	3	2	do	do	8.5950	0.00707	8.5900	8.6000	8.5315	8.6585
			temp	temp	20.2000	0.1414	20.1000	20.3000	18.9294	21.4706
			ph	ph	8.3050	0.00707	8.3000	8.3100	8.2415	8.3685
	4	2	do	do	8.4500	0.1697	8.3300	8.5700	6.9253	9.9747
			temp	temp	20.4000	0.1414	20.3000	20.5000	19.1294	21.6706
			ph	ph	8.2150	0.0636	8.1700	8.2600	7.6432	8.7868
	5	2	do	do	7.8550	0.1344	7.7600	7.9500	6.6479	9.0621
			temp	temp	20.4000	0.1414	20.3000	20.5000	19.1294	21.6706
			ph	ph	8.2000	0.0566	8.1600	8.2400	7.6918	8.7082
	6	2	do	do	8.1300	0.1273	8.0400	8.2200	6.9864	9.2736
			temp	temp	20.5500	0.0707	20.5000	20.6000	19.9147	21.1853
			ph	ph	8.2250	0.0212	8.2100	8.2400	8.0344	8.4156
	7	2	do	do	8.1550	0.0636	8.1100	8.2000	7.5832	8.7268
			temp	temp	20.5500	0.0707	20.5000	20.6000	19.9147	21.1853
			ph	ph	8.1900	0.0424	8.1600	8.2200	7.8088	8.5712
PPB	0	2	do	do	8.4000	0.0849	8.3400	8.4600	7.6376	9.1624
			temp	temp	20.3000	0	20.3000	20.3000	.	.
			ph	ph	7.9700	0.0707	7.9200	8.0200	7.3347	8.6053
	1	2	do	do	8.0700	0.1980	7.9300	8.2100	6.2911	9.8489
			temp	temp	20.6000	0	20.6000	20.6000	.	.
			ph	ph	8.0700	0.0566	8.0300	8.1100	7.5618	8.5782
	2	2	do	do	8.1700	0.0141	8.1600	8.1800	8.0429	8.2971
			temp	temp	20.5500	0.0707	20.5000	20.6000	19.9147	21.1853
			ph	ph	8.0750	0.0212	8.0600	8.0900	7.8844	8.2656
	3	2	do	do	8.1800	0.1697	8.0600	8.3000	6.6553	9.7047
			temp	temp	20.4500	0.0707	20.4000	20.5000	19.8147	21.0853
			ph	ph	8.1500	0.0141	8.1400	8.1600	8.0229	8.2771
	4	2	do	do	8.8150	0.2333	8.6500	8.9800	6.7185	10.9115
			temp	temp	20.2500	0.2121	20.1000	20.4000	18.3441	22.1559
			ph	ph	8.0650	0.0212	8.0500	8.0800	7.8744	8.2556
	5	2	do	do	8.3250	0.1909	8.1900	8.4600	6.6097	10.0403
			temp	temp	20.3000	0.1414	20.2000	20.4000	19.0294	21.5706
			ph	ph	8.2450	0.0495	8.2100	8.2800	7.8003	8.6897
	6	2	do	do	8.2200	0.0141	8.2100	8.2300	8.0929	8.3471
			temp	temp	20.1000	0.1414	20.0000	20.2000	18.8294	21.3706
			ph	ph	8.1400	0.0566	8.1000	8.1800	7.6318	8.6482
	7	2	do	do	8.0950	0.0778	8.0400	8.1500	7.3962	8.7938
			temp	temp	20.4500	0.0707	20.4000	20.5000	19.8147	21.0853

			ph	ph	8.2800	0.0424	8.2500	8.3100	7.8988	8.6612

Performed by K. Weber SAS version 9.4 10:07 07MAY14 KW

AEH-11-PSEUDO-02

Analyzes dissolved oxygen, temperature and pH only

The MEANS Procedure

form=FDP

sps	N Obs	Variable	Label	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
HIC	16	do	do	7.9300	0.2618	7.2800	8.2700	7.7905	8.0695
		temp	temp	19.6438	0.1413	19.3000	19.9000	19.5685	19.7190
		ph	ph	8.2169	0.0591	8.0700	8.2900	8.1854	8.2484
MUC	16	do	do	7.9319	0.2374	7.5500	8.3100	7.8054	8.0584
		temp	temp	19.8000	0.1633	19.6000	20.1000	19.7130	19.8870
		ph	ph	8.2400	0.0482	8.1500	8.3100	8.2143	8.2657
WAS	38	do	do	8.1911	0.2385	7.7600	8.7800	8.1126	8.2695
		temp	temp	19.8921	0.4812	18.7000	20.7000	19.7339	20.0503
		ph	ph	8.1282	0.0561	8.0500	8.3000	8.1097	8.1466

form=SDP

sps	N Obs	Variable	Label	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
BLS	16	do	do	8.4106	0.1498	8.0400	8.6100	8.3308	8.4905
		temp	temp	20.0438	0.1750	19.8000	20.5000	19.9505	20.1370
		ph	ph	8.1994	0.1253	7.8800	8.3000	8.1326	8.2661
FAM	16	do	do	8.0850	0.2990	7.4500	8.7200	7.9257	8.2443
		temp	temp	20.3063	0.2081	20.0000	20.6000	20.1954	20.4171
		ph	ph	8.0088	0.1053	7.8500	8.1500	7.9526	8.0649
HGE	16	do	do	8.1581	0.2753	7.7600	8.6000	8.0114	8.3048
		temp	temp	20.4125	0.1668	20.1000	20.6000	20.3236	20.5014
		ph	ph	8.1969	0.0785	7.9800	8.3100	8.1550	8.2387
PPB	16	do	do	8.2844	0.2563	7.9300	8.9800	8.1478	8.4210
		temp	temp	20.3750	0.1807	20.0000	20.6000	20.2787	20.4713
		ph	ph	8.1244	0.1038	7.9200	8.3100	8.0691	8.1797

Performed by K. Weber SAS version 9.4 10:07 07MAY14 KW

AEH-11-PSEUDO-02

Holding Period Water Chemistry Means for all Species over all holding period days

The MEANS Procedure

Variable	Label	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
do	do	8.1497	0.2853	7.2800	8.9800	8.1010	8.1984
temp	temp	20.0388	0.3945	18.7000	20.7000	19.9714	20.1062
ph	ph	8.1541	0.1055	7.8500	8.3100	8.1361	8.1721
hard		176.7	1.7043	174.0	178.0	175.1	178.3
alk		124.6	4.1576	121.0	131.0	120.7	128.4
con		380.9	13.9813	363.0	402.0	367.9	393.8

Performed by K. Weber SAS version 9.4 10:07 07MAY14 KW

FF # 10
Item No. 10
Pg 12 of 12

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels fr
title2 h=2 'Statistical analysis of holding period water chemistry';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/************************************************************
* SAS ver 9.4       Analysis prepared by:  KLW KW           *
* Analysis completion date:  07MAY14                        *
************************************************************/
```

AEH-11-PSEUDO-02

```
/*****************************************************************************************************
* Variable Names:
* sps = three letter code for mussel species
*           BLS = Black sandshell (Ligumia recta)
*           FAM = Fatmucket (Lampsilis siliquoidea)
*           WAS = Washboard (Megalonaias nervosa)
*           HGE = Higgins eye (Lampsilis higginsii)
*           PPB = Plain pocketbook (Lapsilis cardium)
*           HIC = Hickorynut (Obovaria olivaria)
*           MUC = Mucket (Actinonaias ligamentina)
* day = days post-exposure during holding period (0 through 7)
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
* id = chamber ID
*           i.e., 3A5 = test system (1, 2 or 3), Block ID (A or B), and Position in Block (1 - 6)
* do = dissolved oxygen (mg/L)
* temp = temperautre (C)
* pH = pH
* hard = hardness (mg/L CaCO3)
* alk = alkalinity (mg/L CaCO3)
* cond = conductivity (uS/cm2) temperature compensate to 25C
*****************************************************************************************************

data hold_water_chem; set Pseudo02.hold_water_chem;
    hardy = input(hard, 3.);
        drop hard;
        rename hardy = hard;
    alky = input(alk, 3.);
        drop alk;
        rename alky = alk;
    cony = input(con, 3.);
        drop con;
        rename cony = con;

proc sort data=hold_water_chem; by form sps day id; run;
proc print data=hold_water_chem; run;

title1 h=2 'Holding Period Water Chemistry Means by Species and Formulation for each holding period da
title1 h=2 'Analyzes dissolved oxygen, temperature and pH only';
proc means data = hold_water_chem mean std min max clm fw=8;
by form;
class sps day;
var do temp ph;
```

FF # 10
Item No. 11
Pg 1 of 2

```
run;

title1 h=2 'Holding Period Water Chemistry Means by Species and Formulation for all holding period da
title1 h=2 'Analyzes dissolved oxygen, temperature and pH only';
proc means data = hold_water_chem mean std min max clm fw=8;
by form;
class sps;
var do temp ph;
run;
```

AEH-11-PSEUDO-02

```
title1 h=2 'Holding Period Water Chemistry Means for all Species over all holding period days';
proc means data = hold_water_chem mean std min max clm fw=8;
var do temp ph hard alk con;
run;
```

kw
7MAY2014

FF # 10
Item No. 11
Pg 2 of 2

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile
mussels from seven different unionid species';
title2 h=2 'Statistical analysis of holding period water chemistry';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/***********************************************************
* SAS ver 9.4       Analysis prepared by:  KLW     KW       *
* Analysis completion date:  07MAY14                       *
************************************************************/

/*****************************************************************************************
*************
* Variable Names:
               *
* sps = three letter code for mussel species
               *
*              BLS = Black sandshell (Ligumia recta)
               *
*              FAM = Fatmucket (Lampsilis siliquoidea)
               *
*              WAS = Washboard (Megalonaias nervosa)
               *
*              HGE = Higgins eye (Lampsilis higginsii)
               *
*              PPB = Plain pocketbook (Lapsilis cardium)
               *
*              HIC = Hickorynut (Obovaria olivaria)
               *
*              MUC = Mucket (Actinonaias ligamentina)
               *
* day = days post-exposure during holding period (0 through 7)
               *
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
               *
* id = chamber ID
               *
*              i.e., 3A5 = test system (1, 2 or 3), Block ID (A or B), and Position in Block (1
 - 6)          *
* do = dissolved oxygen (mg/L)
               *
* temp = temperautre (C)
               *
* pH = pH
               *
* hard = hardness (mg/L CaCO3)
               *
* alk = alkalinity (mg/L CaCO3)
               *
* cond = conductivity (uS/cm2) temperature compensate to 25C
               *
```

AEH-11-PSEUDO-02

FF # 10
Item No. 12
Pg 1 of 3

```
**********************************************************************************************
************/

data hold_water_chem; set Pseudo02.hold_water_chem;
    hardy = input(hard, 3.);
        drop hard;
        rename hardy = hard;
    alky = input(alk, 3.);
        drop alk;
        rename alky = alk;
    cony = input(con, 3.);
        drop con;
        rename cony = con;

NOTE: There were 134 observations read from the data set PSEUDO02.HOLD_WATER_CHEM.
NOTE: The data set WORK.HOLD_WATER_CHEM has 134 observations and 10 variables.
NOTE: DATA statement used (Total process time):
      real time           0.02 seconds
      cpu time            0.01 seconds


proc sort data=hold_water_chem; by form sps day id; run;

NOTE: There were 134 observations read from the data set WORK.HOLD_WATER_CHEM.
NOTE: The data set WORK.HOLD_WATER_CHEM has 134 observations and 10 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.01 seconds


proc print data=hold_water_chem; run;
NOTE: Writing HTML Body file: sashtml3.htm

NOTE: There were 134 observations read from the data set WORK.HOLD_WATER_CHEM.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           2.73 seconds
      cpu time            0.67 seconds



title1 h=2 'Holding Period Water Chemistry Means by Species and Formulation for each holding
 period day';
title1 h=2 'Analyzes dissolved oxygen, temperature and pH only';
proc means data = hold_water_chem mean std min max clm fw=8;
by form;
class sps day;
var do temp ph;
run;

NOTE: There were 134 observations read from the data set WORK.HOLD_WATER_CHEM.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.16 seconds
      cpu time            0.12 seconds
```

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```
title1 h=2 'Holding Period Water Chemistry Means by Species and Formulation for all holding period days';
title1 h=2 'Analyzes dissolved oxygen, temperature and pH only';
proc means data = hold_water_chem mean std min max clm fw=8;
by form;
class sps;
var do temp ph;
run;

NOTE: There were 134 observations read from the data set WORK.HOLD_WATER_CHEM.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.05 seconds
      cpu time            0.03 seconds


title1 h=2 'Holding Period Water Chemistry Means for all Species over all holding period days';
proc means data = hold_water_chem mean std min max clm fw=8;
var do temp ph hard alk con;
run;

NOTE: There were 134 observations read from the data set WORK.HOLD_WATER_CHEM.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.05 seconds
      cpu time            0.01 seconds
```

AEH-11-PSEUDO-02

KW
7MAR2014

FF # 10
Item No. 12
Pg 3 of 3

		Action	Date	Initials
Study Number: AEH-11-PSEUDO-02		Created......	1-May-14	KLW
Data Source:	File Folders: 18a	Revised......	19-Nov-14	KLW
	System Condition Form 1	Reviewed...	19 Nov 14	
File Name:	I:\AEH-11-PSEUDO-02\Data\[PSEUDO-02 System Conditions for SAS.xlsx]Flow Rates	Certified...	11/21/14	

System Conditions - Flow Rates

Species, Dosing, and Assessment Information

Scientific Name	Common Name	Abbreviation	Formulation Type	Test Article Lot Number	Exposure Date	Assessment Date
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	12-Jul-11	20-Jul-11
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	14-Jul-11	22-Jul-11
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	13-Dec-11	21-Dec-11
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	27-Jan-12	4-Feb-12
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	17-Apr-12	25-Apr-12
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	16-May-12	24-May-12
Lampsilis higginsii	Higgins eye	HGE	SDP	TR4669-4-(5)	26-May-12	3-Jun-12

Data Codes used within SAS

sps = Juvenile mussel species (see 3 letter abbreviation codes above)
form = Product formulation
- FDP = Freeze dried powder
- SDP = Spray dried powder

day = Sampling date
- -2 = Pre-exposure sampling
- -1 = Exposure day sampling
- 0 to 7 = Day 0 to 7 after exposure

id = Exposure chamber ID
- i.e., 1A2 = Test system (1, 2, or 3), Block ID (A or B), and Position in Block (1-12)

fflow = Measured flow (if oflow was < 7 mL/min, then fflow is the fixed measured flow)
oflow = Original flow if < 7 mL/min

Data Explanation

System condition data analyses were limited to simple descriptive statistics (Proc Means) using SAS Version 9.4.

Data Anomalies and Deviations

NONE

File Folder 18
Item Number 1
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sps	form	day	id	fflow	oflow
BLS	SDP	-2	A1	8.0	.
BLS	SDP	-2	A10	8.4	.
BLS	SDP	-2	A11	7.8	.
BLS	SDP	-2	A12	8.2	.
BLS	SDP	-2	A2	8.2	.
BLS	SDP	-2	A3	8.6	.
BLS	SDP	-2	A4	7.4	.
BLS	SDP	-2	A5	8.4	.
BLS	SDP	-2	A6	8.6	.
BLS	SDP	-2	A7	7.8	.
BLS	SDP	-2	A8	8.6	.
BLS	SDP	-2	A9	8.2	.
BLS	SDP	-2	B1	7.8	.
BLS	SDP	-2	B10	8.2	.
BLS	SDP	-2	B11	9.0	.
BLS	SDP	-2	B12	8.9	.
BLS	SDP	-2	B2	8.2	.
BLS	SDP	-2	B3	9.2	.
BLS	SDP	-2	B4	8.7	.
BLS	SDP	-2	B5	8.7	.
BLS	SDP	-2	B6	8.5	.
BLS	SDP	-2	B7	8.6	.
BLS	SDP	-2	B8	8.1	.
BLS	SDP	-2	B9	8.4	.
BLS	SDP	-1	A1	9.2	.
BLS	SDP	-1	A10	9.3	.
BLS	SDP	-1	A11	9.1	.
BLS	SDP	-1	A12	9.5	.
BLS	SDP	-1	A2	7.7	.
BLS	SDP	-1	A3	8.8	.
BLS	SDP	-1	A4	8.4	.
BLS	SDP	-1	A5	9.0	.
BLS	SDP	-1	A6	8.3	.
BLS	SDP	-1	A7	9.4	4.0
BLS	SDP	-1	A8	9.4	.
BLS	SDP	-1	A9	9.4	.
BLS	SDP	-1	B1	9.0	.
BLS	SDP	-1	B10	9.2	.
BLS	SDP	-1	B11	9.3	.
BLS	SDP	-1	B12	9.4	.
BLS	SDP	-1	B2	8.6	.
BLS	SDP	-1	B3	9.2	5.8
BLS	SDP	-1	B4	9.4	.
BLS	SDP	-1	B5	9.8	.
BLS	SDP	-1	B6	9.0	.
BLS	SDP	-1	B7	9.0	.

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BLS	SDP	-1	B8	8.3	.
BLS	SDP	-1	B9	8.6	.
BLS	SDP	0	A1	7.2	.
BLS	SDP	0	A10	7.7	.
BLS	SDP	0	A11	7.8	.
BLS	SDP	0	A12	7.4	.
BLS	SDP	0	A2	7.5	.
BLS	SDP	0	A3	7.6	.
BLS	SDP	0	A4	7.6	.
BLS	SDP	0	A5	7.2	.
BLS	SDP	0	A6	7.6	.
BLS	SDP	0	A7	7.3	.
BLS	SDP	0	A8	7.4	.
BLS	SDP	0	A9	7.8	.
BLS	SDP	0	B1	7.0	.
BLS	SDP	0	B10	7.6	.
BLS	SDP	0	B11	8.0	.
BLS	SDP	0	B12	8.0	.
BLS	SDP	0	B2	7.6	.
BLS	SDP	0	B3	7.6	.
BLS	SDP	0	B4	8.5	.
BLS	SDP	0	B5	8.2	.
BLS	SDP	0	B6	8.1	.
BLS	SDP	0	B7	8.1	.
BLS	SDP	0	B8	7.7	.
BLS	SDP	0	B9	7.8	.
BLS	SDP	1	A1	7.8	.
BLS	SDP	1	A2	9.1	.
BLS	SDP	1	A3	9.0	.
BLS	SDP	1	A4	9.4	.
BLS	SDP	1	B1	9.4	.
BLS	SDP	1	B2	9.0	.
BLS	SDP	1	B3	9.1	.
BLS	SDP	1	B4	8.6	.
BLS	SDP	2	A1	9.5	.
BLS	SDP	2	A2	8.9	.
BLS	SDP	2	A3	9.0	.
BLS	SDP	2	A4	9.2	.
BLS	SDP	2	B1	9.1	.
BLS	SDP	2	B2	9.2	.
BLS	SDP	2	B3	9.1	.
BLS	SDP	2	B4	9.4	.
BLS	SDP	3	A1	8.4	.
BLS	SDP	3	A2	9.4	.
BLS	SDP	3	A3	8.9	.
BLS	SDP	3	A4	9.3	.
BLS	SDP	3	B1	8.6	.

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BLS	SDP	3	B2	8.6	.
BLS	SDP	3	B3	8.7	.
BLS	SDP	3	B4	9.6	.
BLS	SDP	4	A1	7.4	.
BLS	SDP	4	A2	8.2	.
BLS	SDP	4	A3	9.0	.
BLS	SDP	4	A4	9.1	.
BLS	SDP	4	B1	9.2	.
BLS	SDP	4	B2	8.8	.
BLS	SDP	4	B3	8.6	.
BLS	SDP	4	B4	8.4	.
BLS	SDP	5	A1	9.4	.
BLS	SDP	5	A2	8.3	.
BLS	SDP	5	A3	9.4	.
BLS	SDP	5	A4	9.2	.
BLS	SDP	5	B1	9.0	.
BLS	SDP	5	B2	9.4	.
BLS	SDP	5	B3	9.4	.
BLS	SDP	5	B4	9.5	.
BLS	SDP	6	A1	8.7	.
BLS	SDP	6	A2	8.3	.
BLS	SDP	6	A3	9.4	.
BLS	SDP	6	A4	9.8	.
BLS	SDP	6	B1	8.4	.
BLS	SDP	6	B2	9.0	.
BLS	SDP	6	B3	9.2	.
BLS	SDP	6	B4	9.8	.
BLS	SDP	7	A1	10.0	.
BLS	SDP	7	A2	9.0	.
BLS	SDP	7	A3	9.6	.
BLS	SDP	7	A4	8.2	.
BLS	SDP	7	B1	7.3	.
BLS	SDP	7	B2	9.4	.
BLS	SDP	7	B3	9.3	.
BLS	SDP	7	B4	9.6	.
FAM	SDP	-2	A1	8.8	.
FAM	SDP	-2	A10	8.0	.
FAM	SDP	-2	A11	8.8	.
FAM	SDP	-2	A12	7.8	.
FAM	SDP	-2	A2	8.2	.
FAM	SDP	-2	A3	8.0	.
FAM	SDP	-2	A4	7.4	.
FAM	SDP	-2	A5	7.6	.
FAM	SDP	-2	A6	7.6	.
FAM	SDP	-2	A7	8.0	.
FAM	SDP	-2	A8	8.0	.
FAM	SDP	-2	A9	7.8	.

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FAM	SDP	-2	B1	8.0	.
FAM	SDP	-2	B10	7.6	.
FAM	SDP	-2	B11	8.4	.
FAM	SDP	-2	B12	8.6	.
FAM	SDP	-2	B2	7.4	.
FAM	SDP	-2	B3	7.8	.
FAM	SDP	-2	B4	8.4	.
FAM	SDP	-2	B5	9.0	.
FAM	SDP	-2	B6	7.8	.
FAM	SDP	-2	B7	8.2	.
FAM	SDP	-2	B8	7.8	.
FAM	SDP	-2	B9	8.6	.
FAM	SDP	-1	A1	8.4	.
FAM	SDP	-1	A10	8.6	.
FAM	SDP	-1	A11	7.3	.
FAM	SDP	-1	A12	8.1	.
FAM	SDP	-1	A2	8.2	.
FAM	SDP	-1	A3	8.4	.
FAM	SDP	-1	A4	7.2	.
FAM	SDP	-1	A5	8.0	.
FAM	SDP	-1	A6	7.5	.
FAM	SDP	-1	A7	8.8	.
FAM	SDP	-1	A8	8.1	.
FAM	SDP	-1	A9	8.5	.
FAM	SDP	-1	B1	8.5	.
FAM	SDP	-1	B10	7.9	.
FAM	SDP	-1	B11	8.2	.
FAM	SDP	-1	B12	8.0	.
FAM	SDP	-1	B2	8.0	.
FAM	SDP	-1	B3	8.1	.
FAM	SDP	-1	B4	9.4	.
FAM	SDP	-1	B5	8.2	.
FAM	SDP	-1	B6	8.4	6.1
FAM	SDP	-1	B7	8.0	.
FAM	SDP	-1	B8	8.0	.
FAM	SDP	-1	B9	8.2	.
FAM	SDP	0	A1	8.4	.
FAM	SDP	0	A10	8.4	.
FAM	SDP	0	A11	9.0	6.0
FAM	SDP	0	A12	8.4	.
FAM	SDP	0	A2	9.2	.
FAM	SDP	0	A3	8.6	.
FAM	SDP	0	A4	8.0	.
FAM	SDP	0	A5	8.0	.
FAM	SDP	0	A6	7.4	.
FAM	SDP	0	A7	8.6	.
FAM	SDP	0	A8	8.4	.

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FAM	SDP	0	A9	8.8	.
FAM	SDP	0	B1	8.2	.
FAM	SDP	0	B10	8.2	.
FAM	SDP	0	B11	8.3	.
FAM	SDP	0	B12	9.0	.
FAM	SDP	0	B2	8.3	.
FAM	SDP	0	B3	8.4	.
FAM	SDP	0	B4	9.6	.
FAM	SDP	0	B5	8.3	.
FAM	SDP	0	B6	8.5	.
FAM	SDP	0	B7	8.3	.
FAM	SDP	0	B8	7.1	.
FAM	SDP	0	B9	7.7	.
FAM	SDP	1	A1	8.5	.
FAM	SDP	1	A2	8.6	.
FAM	SDP	1	A3	9.0	.
FAM	SDP	1	A4	7.8	.
FAM	SDP	1	B1	9.3	.
FAM	SDP	1	B2	8.2	.
FAM	SDP	1	B3	8.4	.
FAM	SDP	1	B4	9.6	.
FAM	SDP	1	B5	7.5	5.0
FAM	SDP	2	A1	7.7	.
FAM	SDP	2	A2	8.0	.
FAM	SDP	2	A3	7.7	.
FAM	SDP	2	A4	8.1	.
FAM	SDP	2	B1	7.8	.
FAM	SDP	2	B2	8.7	.
FAM	SDP	2	B3	8.5	.
FAM	SDP	2	B4	9.4	6.8
FAM	SDP	3	A1	7.2	.
FAM	SDP	3	A2	9.5	6.5
FAM	SDP	3	A3	7.5	.
FAM	SDP	3	A4	10.6	6.4
FAM	SDP	3	B1	7.2	.
FAM	SDP	3	B2	9.0	6.6
FAM	SDP	3	B3	7.3	.
FAM	SDP	3	B4	7.3	.
FAM	SDP	4	A1	8.2	.
FAM	SDP	4	A2	8.7	.
FAM	SDP	4	A3	8.8	.
FAM	SDP	4	A4	7.3	.
FAM	SDP	4	B1	8.8	.
FAM	SDP	4	B2	8.2	.
FAM	SDP	4	B3	9.8	3.5
FAM	SDP	4	B4	9.0	.
FAM	SDP	5	A1	8.5	6.8

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FAM	SDP	5	A2	8.0	.
FAM	SDP	5	A3	7.8	.
FAM	SDP	5	A4	7.7	.
FAM	SDP	5	B1	8.2	6.6
FAM	SDP	5	B2	7.5	.
FAM	SDP	5	B3	8.6	.
FAM	SDP	5	B4	9.3	.
FAM	SDP	6	A1	8.8	.
FAM	SDP	6	A2	9.4	.
FAM	SDP	6	A3	8.6	.
FAM	SDP	6	A4	9.8	.
FAM	SDP	6	B1	8.6	.
FAM	SDP	6	B2	8.8	.
FAM	SDP	6	B3	8.6	.
FAM	SDP	6	B4	8.7	.
FAM	SDP	7	A1	8.0	.
FAM	SDP	7	A2	8.6	.
FAM	SDP	7	A3	8.2	.
FAM	SDP	7	A4	8.4	.
FAM	SDP	7	B1	8.6	.
FAM	SDP	7	B2	7.8	.
FAM	SDP	7	B3	9.4	.
FAM	SDP	7	B4	8.6	.
HGE	SDP	-2	A1	7.8	.
HGE	SDP	-2	A10	8.6	6.7
HGE	SDP	-2	A11	7.9	.
HGE	SDP	-2	A12	8.8	.
HGE	SDP	-2	A2	7.9	.
HGE	SDP	-2	A3	7.9	.
HGE	SDP	-2	A4	9.0	6.8
HGE	SDP	-2	A5	7.3	.
HGE	SDP	-2	A6	7.9	.
HGE	SDP	-2	A7	7.8	.
HGE	SDP	-2	A8	7.3	6.4
HGE	SDP	-2	A9	7.4	.
HGE	SDP	-2	B1	7.6	.
HGE	SDP	-2	B10	7.8	.
HGE	SDP	-2	B11	7.4	.
HGE	SDP	-2	B12	7.2	.
HGE	SDP	-2	B2	7.4	.
HGE	SDP	-2	B3	8.4	.
HGE	SDP	-2	B4	8.2	.
HGE	SDP	-2	B5	8.2	.
HGE	SDP	-2	B6	7.3	.
HGE	SDP	-2	B7	8.1	.
HGE	SDP	-2	B8	8.0	.
HGE	SDP	-2	B9	8.1	.

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HGE	SDP	-1	A1	9.2	.
HGE	SDP	-1	A10	9.0	.
HGE	SDP	-1	A11	7.7	.
HGE	SDP	-1	A12	8.9	.
HGE	SDP	-1	A2	9.0	.
HGE	SDP	-1	A3	8.8	.
HGE	SDP	-1	A4	9.4	.
HGE	SDP	-1	A5	8.8	.
HGE	SDP	-1	A6	8.6	.
HGE	SDP	-1	A7	9.0	.
HGE	SDP	-1	A8	9.0	6.8
HGE	SDP	-1	A9	8.6	.
HGE	SDP	-1	B1	7.0	.
HGE	SDP	-1	B10	9.0	.
HGE	SDP	-1	B11	8.4	.
HGE	SDP	-1	B12	9.8	5.8
HGE	SDP	-1	B2	9.1	5.5
HGE	SDP	-1	B3	9.0	.
HGE	SDP	-1	B4	9.0	.
HGE	SDP	-1	B5	9.2	.
HGE	SDP	-1	B6	9.1	.
HGE	SDP	-1	B7	8.9	6.2
HGE	SDP	-1	B8	9.4	5.7
HGE	SDP	-1	B9	9.0	6.2
HGE	SDP	0	A1	8.3	.
HGE	SDP	0	A10	9.0	.
HGE	SDP	0	A11	7.3	.
HGE	SDP	0	A12	9.4	.
HGE	SDP	0	A2	9.8	.
HGE	SDP	0	A3	8.5	.
HGE	SDP	0	A4	9.5	.
HGE	SDP	0	A5	8.6	.
HGE	SDP	0	A6	8.2	.
HGE	SDP	0	A7	8.8	.
HGE	SDP	0	A8	8.0	.
HGE	SDP	0	A9	9.3	.
HGE	SDP	0	B1	9.1	6.6
HGE	SDP	0	B10	8.8	.
HGE	SDP	0	B11	8.2	.
HGE	SDP	0	B12	8.8	.
HGE	SDP	0	B2	10.4	5.1
HGE	SDP	0	B3	8.8	.
HGE	SDP	0	B4	9.4	.
HGE	SDP	0	B5	9.0	6.9
HGE	SDP	0	B6	9.0	.
HGE	SDP	0	B7	8.3	.
HGE	SDP	0	B8	9.1	.

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HGE	SDP	0	B9	9.0	.
HGE	SDP	1	A1	8.6	.
HGE	SDP	1	A2	9.0	.
HGE	SDP	1	A3	8.1	.
HGE	SDP	1	A4	9.0	.
HGE	SDP	1	B1	9.5	.
HGE	SDP	1	B2	8.9	.
HGE	SDP	1	B3	8.0	.
HGE	SDP	1	B4	8.8	.
HGE	SDP	2	A1	7.8	.
HGE	SDP	2	A2	8.8	.
HGE	SDP	2	A3	10.0	.
HGE	SDP	2	A4	9.0	.
HGE	SDP	2	B1	9.1	.
HGE	SDP	2	B2	8.6	.
HGE	SDP	2	B3	9.2	.
HGE	SDP	2	B4	9.3	.
HGE	SDP	3	A1	8.4	.
HGE	SDP	3	A2	9.0	.
HGE	SDP	3	A3	8.6	.
HGE	SDP	3	A4	9.7	.
HGE	SDP	3	B1	9.0	.
HGE	SDP	3	B2	9.6	.
HGE	SDP	3	B3	8.5	.
HGE	SDP	3	B4	9.0	.
HGE	SDP	4	A1	9.6	.
HGE	SDP	4	A2	8.3	.
HGE	SDP	4	A3	8.3	.
HGE	SDP	4	A4	8.5	.
HGE	SDP	4	B1	8.1	.
HGE	SDP	4	B2	8.8	.
HGE	SDP	4	B3	9.0	.
HGE	SDP	4	B4	8.8	.
HGE	SDP	5	A1	7.3	.
HGE	SDP	5	A2	8.5	.
HGE	SDP	5	A3	8.8	.
HGE	SDP	5	A4	8.2	.
HGE	SDP	5	B1	7.5	.
HGE	SDP	5	B2	8.7	.
HGE	SDP	5	B3	8.0	.
HGE	SDP	5	B4	9.5	.
HGE	SDP	6	A1	8.0	.
HGE	SDP	6	A2	9.3	.
HGE	SDP	6	A3	8.0	.
HGE	SDP	6	A4	9.9	.
HGE	SDP	6	B1	8.8	.
HGE	SDP	6	B2	9.4	.

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HGE	SDP	6	B3	8.0	.
HGE	SDP	6	B4	8.4	.
HGE	SDP	7	A1	8.1	.
HGE	SDP	7	A2	8.9	.
HGE	SDP	7	A3	8.8	.
HGE	SDP	7	A4	8.4	.
HGE	SDP	7	B1	9.6	.
HGE	SDP	7	B2	8.1	.
HGE	SDP	7	B3	8.4	.
HGE	SDP	7	B4	8.8	.
HIC	FDP	-2	A1	8.8	.
HIC	FDP	-2	A10	8.9	.
HIC	FDP	-2	A11	9.0	.
HIC	FDP	-2	A12	8.9	.
HIC	FDP	-2	A2	8.8	.
HIC	FDP	-2	A3	8.2	.
HIC	FDP	-2	A4	7.5	.
HIC	FDP	-2	A5	9.4	.
HIC	FDP	-2	A6	7.5	.
HIC	FDP	-2	A7	8.6	.
HIC	FDP	-2	A8	7.6	.
HIC	FDP	-2	A9	9.8	.
HIC	FDP	-2	B1	9.2	.
HIC	FDP	-2	B10	9.8	.
HIC	FDP	-2	B11	9.4	.
HIC	FDP	-2	B12	8.4	.
HIC	FDP	-2	B2	7.8	.
HIC	FDP	-2	B3	8.9	.
HIC	FDP	-2	B4	8.7	.
HIC	FDP	-2	B5	8.4	.
HIC	FDP	-2	B6	8.6	.
HIC	FDP	-2	B7	9.4	.
HIC	FDP	-2	B8	8.8	.
HIC	FDP	-2	B9	8.0	.
HIC	FDP	-1	A1	8.8	.
HIC	FDP	-1	A2	8.2	.
HIC	FDP	-1	A3	8.6	.
HIC	FDP	-1	A4	9.3	.
HIC	FDP	-1	B1	9.2	.
HIC	FDP	-1	B2	8.1	.
HIC	FDP	-1	B3	8.6	.
HIC	FDP	-1	B4	8.9	.
HIC	FDP	0	A1	9.0	.
HIC	FDP	0	A10	9.0	.
HIC	FDP	0	A11	9.2	5.0
HIC	FDP	0	A12	8.8	.
HIC	FDP	0	A2	8.2	.

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HIC	FDP	0	A3	7.8	.
HIC	FDP	0	A4	9.1	.
HIC	FDP	0	A5	9.4	.
HIC	FDP	0	A6	9.0	.
HIC	FDP	0	A7	8.9	.
HIC	FDP	0	A8	8.1	.
HIC	FDP	0	A9	9.4	.
HIC	FDP	0	B1	9.2	.
HIC	FDP	0	B10	9.8	.
HIC	FDP	0	B11	9.0	.
HIC	FDP	0	B12	8.7	.
HIC	FDP	0	B2	8.2	.
HIC	FDP	0	B3	9.3	.
HIC	FDP	0	B4	9.1	.
HIC	FDP	0	B5	8.2	.
HIC	FDP	0	B6	8.6	.
HIC	FDP	0	B7	9.8	.
HIC	FDP	0	B8	9.0	.
HIC	FDP	0	B9	8.6	.
HIC	FDP	1	A1	9.3	.
HIC	FDP	1	A2	9.1	.
HIC	FDP	1	A3	9.0	.
HIC	FDP	1	A4	8.2	.
HIC	FDP	1	B1	8.6	.
HIC	FDP	1	B2	8.4	.
HIC	FDP	1	B3	9.7	.
HIC	FDP	1	B4	9.6	.
HIC	FDP	2	A1	9.4	.
HIC	FDP	2	A2	8.8	.
HIC	FDP	2	A3	9.0	.
HIC	FDP	2	A4	8.8	.
HIC	FDP	2	B1	8.3	.
HIC	FDP	2	B2	9.6	.
HIC	FDP	2	B3	8.6	.
HIC	FDP	2	B4	8.6	.
HIC	FDP	3	A1	8.6	.
HIC	FDP	3	A2	8.4	.
HIC	FDP	3	A3	7.8	.
HIC	FDP	3	A4	8.4	.
HIC	FDP	3	B1	8.3	.
HIC	FDP	3	B2	8.6	.
HIC	FDP	3	B3	9.0	.
HIC	FDP	3	B4	8.6	.
HIC	FDP	4	A1	9.0	.
HIC	FDP	4	A2	8.7	.
HIC	FDP	4	A3	8.4	.
HIC	FDP	4	A4	8.7	.

HIC	FDP	4	B1	8.3	.
HIC	FDP	4	B2	8.3	.
HIC	FDP	4	B3	9.4	.
HIC	FDP	4	B4	9.3	.
HIC	FDP	5	A1	8.8	.
HIC	FDP	5	A2	9.3	.
HIC	FDP	5	A3	8.7	.
HIC	FDP	5	A4	8.8	.
HIC	FDP	5	B1	8.3	.
HIC	FDP	5	B2	9.7	.
HIC	FDP	5	B3	9.2	.
HIC	FDP	5	B4	8.4	.
HIC	FDP	6	A1	8.3	.
HIC	FDP	6	A2	8.1	.
HIC	FDP	6	A3	7.5	.
HIC	FDP	6	A4	7.9	.
HIC	FDP	6	B1	8.1	.
HIC	FDP	6	B2	8.0	.
HIC	FDP	6	B3	8.7	.
HIC	FDP	6	B4	8.6	.
HIC	FDP	7	A1	8.6	.
HIC	FDP	7	A2	8.6	.
HIC	FDP	7	A3	8.2	.
HIC	FDP	7	A4	8.6	.
HIC	FDP	7	B1	8.0	.
HIC	FDP	7	B2	8.3	.
HIC	FDP	7	B3	9.1	.
HIC	FDP	7	B4	8.9	.
MUC	FDP	-2	A1	8.6	.
MUC	FDP	-2	A10	9.2	.
MUC	FDP	-2	A11	8.6	.
MUC	FDP	-2	A12	8.9	.
MUC	FDP	-2	A2	7.6	.
MUC	FDP	-2	A3	9.2	.
MUC	FDP	-2	A4	8.0	.
MUC	FDP	-2	A5	8.4	.
MUC	FDP	-2	A6	8.3	.
MUC	FDP	-2	A7	8.9	.
MUC	FDP	-2	A8	8.7	.
MUC	FDP	-2	A9	8.7	.
MUC	FDP	-2	B1	9.8	.
MUC	FDP	-2	B10	8.6	.
MUC	FDP	-2	B11	9.0	.
MUC	FDP	-2	B12	9.9	.
MUC	FDP	-2	B2	9.2	.
MUC	FDP	-2	B3	9.6	.
MUC	FDP	-2	B4	10.0	.

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MUC	FDP	-2	B5	10.4	.
MUC	FDP	-2	B6	10.0	.
MUC	FDP	-2	B7	9.9	.
MUC	FDP	-2	B8	9.9	.
MUC	FDP	-2	B9	9.6	.
MUC	FDP	-1	A1	9.2	.
MUC	FDP	-1	A2	8.5	.
MUC	FDP	-1	A3	9.4	.
MUC	FDP	-1	A4	8.9	.
MUC	FDP	-1	B1	9.6	.
MUC	FDP	-1	B2	9.2	.
MUC	FDP	-1	B3	9.2	.
MUC	FDP	-1	B4	10.3	.
MUC	FDP	0	A1	8.6	.
MUC	FDP	0	A10	9.5	.
MUC	FDP	0	A11	9.5	.
MUC	FDP	0	A12	10.0	.
MUC	FDP	0	A2	8.8	.
MUC	FDP	0	A3	9.5	.
MUC	FDP	0	A4	9.4	.
MUC	FDP	0	A5	8.8	.
MUC	FDP	0	A6	8.7	.
MUC	FDP	0	A7	9.8	.
MUC	FDP	0	A8	8.6	.
MUC	FDP	0	A9	9.2	.
MUC	FDP	0	B1	9.7	.
MUC	FDP	0	B10	8.4	.
MUC	FDP	0	B11	9.6	.
MUC	FDP	0	B12	9.3	.
MUC	FDP	0	B2	9.4	.
MUC	FDP	0	B3	9.8	.
MUC	FDP	0	B4	10.2	.
MUC	FDP	0	B5	10.6	.
MUC	FDP	0	B6	10.5	.
MUC	FDP	0	B7	8.8	.
MUC	FDP	0	B8	10.2	.
MUC	FDP	0	B9	9.4	.
MUC	FDP	1	A1	8.6	.
MUC	FDP	1	A2	8.3	.
MUC	FDP	1	A3	9.4	.
MUC	FDP	1	A4	9.6	.
MUC	FDP	1	B1	9.4	.
MUC	FDP	1	B2	9.2	.
MUC	FDP	1	B3	9.6	.
MUC	FDP	1	B4	10.0	.
MUC	FDP	2	A1	8.6	.
MUC	FDP	2	A2	8.8	.

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MUC	FDP	2	A3	9.6	.
MUC	FDP	2	A4	9.0	.
MUC	FDP	2	B1	10.4	.
MUC	FDP	2	B2	10.3	.
MUC	FDP	2	B3	9.4	.
MUC	FDP	2	B4	10.0	.
MUC	FDP	3	A1	9.1	.
MUC	FDP	3	A2	9.6	.
MUC	FDP	3	A3	9.4	.
MUC	FDP	3	A4	10.2	.
MUC	FDP	3	B1	7.6	.
MUC	FDP	3	B2	8.6	.
MUC	FDP	3	B3	9.6	.
MUC	FDP	3	B4	9.7	.
MUC	FDP	4	A1	7.2	.
MUC	FDP	4	A2	8.6	.
MUC	FDP	4	A3	9.2	.
MUC	FDP	4	A4	9.1	.
MUC	FDP	4	B1	9.1	.
MUC	FDP	4	B2	9.2	.
MUC	FDP	4	B3	9.1	.
MUC	FDP	4	B4	9.6	.
MUC	FDP	5	A1	8.0	.
MUC	FDP	5	A2	9.2	.
MUC	FDP	5	A3	8.9	.
MUC	FDP	5	A4	8.8	.
MUC	FDP	5	B1	9.2	.
MUC	FDP	5	B2	10.2	.
MUC	FDP	5	B3	9.9	.
MUC	FDP	5	B4	9.6	.
MUC	FDP	6	A1	8.5	.
MUC	FDP	6	A2	9.4	.
MUC	FDP	6	A3	8.3	.
MUC	FDP	6	A4	9.8	.
MUC	FDP	6	B1	9.2	.
MUC	FDP	6	B2	8.8	.
MUC	FDP	6	B3	8.2	.
MUC	FDP	6	B4	9.2	.
MUC	FDP	7	A1	6.0	.
MUC	FDP	7	A2	8.1	.
MUC	FDP	7	A3	9.2	.
MUC	FDP	7	A4	8.8	.
MUC	FDP	7	B1	9.0	.
MUC	FDP	7	B2	8.9	.
MUC	FDP	7	B3	9.2	.
MUC	FDP	7	B4	9.5	.
PPB	SDP	-2	A1	7.8	.

PPB	SDP	-2	A10	8.4	.
PPB	SDP	-2	A11	8.2	.
PPB	SDP	-2	A12	7.6	.
PPB	SDP	-2	A2	7.9	.
PPB	SDP	-2	A3	7.6	.
PPB	SDP	-2	A4	8.3	.
PPB	SDP	-2	A5	7.4	.
PPB	SDP	-2	A6	7.8	.
PPB	SDP	-2	A7	8.2	.
PPB	SDP	-2	A8	8.0	.
PPB	SDP	-2	A9	7.4	.
PPB	SDP	-2	B1	8.3	.
PPB	SDP	-2	B10	8.1	.
PPB	SDP	-2	B11	8.7	.
PPB	SDP	-2	B12	8.3	.
PPB	SDP	-2	B2	8.0	.
PPB	SDP	-2	B3	8.0	.
PPB	SDP	-2	B4	8.6	.
PPB	SDP	-2	B5	7.2	.
PPB	SDP	-2	B6	8.1	.
PPB	SDP	-2	B7	7.9	.
PPB	SDP	-2	B8	8.0	.
PPB	SDP	-2	B9	8.3	.
PPB	SDP	-1	A1	8.1	.
PPB	SDP	-1	A10	8.4	.
PPB	SDP	-1	A11	8.4	.
PPB	SDP	-1	A12	8.0	.
PPB	SDP	-1	A2	8.0	.
PPB	SDP	-1	A3	7.6	.
PPB	SDP	-1	A4	8.0	.
PPB	SDP	-1	A5	7.4	.
PPB	SDP	-1	A6	7.9	.
PPB	SDP	-1	A7	7.8	.
PPB	SDP	-1	A8	7.2	.
PPB	SDP	-1	A9	8.2	.
PPB	SDP	-1	B1	8.2	.
PPB	SDP	-1	B10	7.9	.
PPB	SDP	-1	B11	8.4	.
PPB	SDP	-1	B12	8.5	.
PPB	SDP	-1	B2	7.9	.
PPB	SDP	-1	B3	7.8	.
PPB	SDP	-1	B4	8.5	.
PPB	SDP	-1	B5	7.9	.
PPB	SDP	-1	B6	7.7	.
PPB	SDP	-1	B7	8.4	.
PPB	SDP	-1	B8	7.8	.
PPB	SDP	-1	B9	8.1	.

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PPB	SDP	0	A1	8.0	.
PPB	SDP	0	A10	8.0	.
PPB	SDP	0	A11	8.5	.
PPB	SDP	0	A12	8.0	.
PPB	SDP	0	A2	8.6	.
PPB	SDP	0	A3	7.0	.
PPB	SDP	0	A4	8.2	.
PPB	SDP	0	A5	7.4	.
PPB	SDP	0	A6	7.8	.
PPB	SDP	0	A7	8.0	.
PPB	SDP	0	A8	7.5	.
PPB	SDP	0	A9	8.8	.
PPB	SDP	0	B1	7.8	.
PPB	SDP	0	B10	7.6	.
PPB	SDP	0	B11	7.9	.
PPB	SDP	0	B12	7.4	.
PPB	SDP	0	B2	7.4	.
PPB	SDP	0	B3	7.3	.
PPB	SDP	0	B4	7.7	.
PPB	SDP	0	B5	7.8	.
PPB	SDP	0	B6	7.2	.
PPB	SDP	0	B7	7.8	.
PPB	SDP	0	B8	7.0	.
PPB	SDP	0	B9	7.5	.
PPB	SDP	1	A1	8.2	.
PPB	SDP	1	A2	8.6	.
PPB	SDP	1	A3	8.1	.
PPB	SDP	1	A4	8.4	.
PPB	SDP	1	B1	8.0	.
PPB	SDP	1	B2	7.8	.
PPB	SDP	1	B3	8.0	.
PPB	SDP	1	B4	8.4	.
PPB	SDP	2	A1	8.4	.
PPB	SDP	2	A2	7.7	.
PPB	SDP	2	A3	8.4	.
PPB	SDP	2	A4	7.6	.
PPB	SDP	2	B1	7.4	.
PPB	SDP	2	B2	8.4	.
PPB	SDP	2	B3	7.7	.
PPB	SDP	2	B4	8.3	.
PPB	SDP	3	A1	9.4	.
PPB	SDP	3	A2	8.2	.
PPB	SDP	3	A3	8.4	.
PPB	SDP	3	A4	8.0	.
PPB	SDP	3	B1	8.6	.
PPB	SDP	3	B2	8.0	.
PPB	SDP	3	B3	8.3	.

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PPB	SDP	3	B4	7.6	.
PPB	SDP	4	A1	7.8	.
PPB	SDP	4	A2	7.4	.
PPB	SDP	4	A3	7.8	.
PPB	SDP	4	A4	7.8	.
PPB	SDP	4	B1	8.4	.
PPB	SDP	4	B2	7.4	.
PPB	SDP	4	B3	7.7	.
PPB	SDP	4	B4	8.1	.
PPB	SDP	5	A1	7.1	.
PPB	SDP	5	A2	8.0	.
PPB	SDP	5	A3	7.9	.
PPB	SDP	5	A4	7.3	.
PPB	SDP	5	B1	8.2	.
PPB	SDP	5	B2	7.4	.
PPB	SDP	5	B3	8.3	.
PPB	SDP	5	B4	8.2	.
PPB	SDP	6	A1	9.5	.
PPB	SDP	6	A2	7.4	.
PPB	SDP	6	A3	8.4	.
PPB	SDP	6	A4	7.8	.
PPB	SDP	6	B1	8.3	.
PPB	SDP	6	B2	8.0	.
PPB	SDP	6	B3	8.3	.
PPB	SDP	6	B4	7.5	.
PPB	SDP	7	A1	7.6	.
PPB	SDP	7	A2	8.3	.
PPB	SDP	7	A3	7.6	.
PPB	SDP	7	A4	7.8	.
PPB	SDP	7	B1	8.2	.
PPB	SDP	7	B2	7.3	.
PPB	SDP	7	B3	7.7	.
PPB	SDP	7	B4	8.2	.
WAS	FDP	-2	A1	9.2	.
WAS	FDP	-2	A10	8.6	.
WAS	FDP	-2	A11	8.2	.
WAS	FDP	-2	A12	8.8	.
WAS	FDP	-2	A2	8.4	.
WAS	FDP	-2	A3	8.2	.
WAS	FDP	-2	A4	8.8	.
WAS	FDP	-2	A5	9.2	.
WAS	FDP	-2	A6	8.2	.
WAS	FDP	-2	A7	8.7	.
WAS	FDP	-2	A8	8.6	.
WAS	FDP	-2	A9	8.4	.
WAS	FDP	-2	B1	8.4	.
WAS	FDP	-2	B10	8.7	.

WAS	FDP	-2	B11	8.7	.
WAS	FDP	-2	B12	8.6	.
WAS	FDP	-2	B2	8.5	.
WAS	FDP	-2	B3	8.8	.
WAS	FDP	-2	B4	8.2	.
WAS	FDP	-2	B5	8.2	.
WAS	FDP	-2	B6	8.0	.
WAS	FDP	-2	B7	8.2	.
WAS	FDP	-2	B8	7.6	.
WAS	FDP	-2	B9	7.9	.
WAS	FDP	-1	A1	8.3	6.6
WAS	FDP	-1	A10	8.5	.
WAS	FDP	-1	A11	7.2	3.8
WAS	FDP	-1	A12	8.9	.
WAS	FDP	-1	A2	8.0	.
WAS	FDP	-1	A3	9.1	6.1
WAS	FDP	-1	A4	8.0	.
WAS	FDP	-1	A5	7.9	.
WAS	FDP	-1	A6	8.0	.
WAS	FDP	-1	A7	8.3	.
WAS	FDP	-1	A8	8.9	.
WAS	FDP	-1	A9	8.4	.
WAS	FDP	-1	B1	8.5	.
WAS	FDP	-1	B10	9.2	.
WAS	FDP	-1	B11	8.2	.
WAS	FDP	-1	B12	8.2	.
WAS	FDP	-1	B2	8.9	0.5
WAS	FDP	-1	B3	8.4	.
WAS	FDP	-1	B4	9.0	6.3
WAS	FDP	-1	B5	8.1	.
WAS	FDP	-1	B6	7.9	.
WAS	FDP	-1	B7	8.4	.
WAS	FDP	-1	B8	8.5	6.8
WAS	FDP	-1	B9	9.0	6.4
WAS	FDP	0	A1	8.4	.
WAS	FDP	0	A10	8.6	.
WAS	FDP	0	A11	9.0	.
WAS	FDP	0	A12	9.0	.
WAS	FDP	0	A2	9.4	.
WAS	FDP	0	A3	9.4	.
WAS	FDP	0	A4	9.0	.
WAS	FDP	0	A5	9.0	.
WAS	FDP	0	A6	8.4	.
WAS	FDP	0	A7	8.4	.
WAS	FDP	0	A8	9.0	.
WAS	FDP	0	A9	8.6	.
WAS	FDP	0	B1	8.6	.

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WAS	FDP	0	B10	9.0	.
WAS	FDP	0	B11	8.8	.
WAS	FDP	0	B12	9.2	.
WAS	FDP	0	B2	8.6	.
WAS	FDP	0	B3	8.8	.
WAS	FDP	0	B4	8.6	.
WAS	FDP	0	B5	8.1	.
WAS	FDP	0	B6	8.0	.
WAS	FDP	0	B7	8.4	.
WAS	FDP	0	B8	8.6	.
WAS	FDP	0	B9	9.2	.
WAS	FDP	1	A1	9.0	.
WAS	FDP	1	A2	8.4	.
WAS	FDP	1	A3	9.4	.
WAS	FDP	1	A4	8.8	.
WAS	FDP	1	B1	8.6	.
WAS	FDP	1	B2	8.4	.
WAS	FDP	1	B3	8.8	.
WAS	FDP	1	B4	8.6	.
WAS	FDP	2	A1	9.2	.
WAS	FDP	2	A2	8.6	.
WAS	FDP	2	A3	8.2	.
WAS	FDP	2	A4	8.7	.
WAS	FDP	2	B1	8.8	.
WAS	FDP	2	B2	7.9	.
WAS	FDP	2	B3	8.6	.
WAS	FDP	2	B4	9.6	.
WAS	FDP	3	A1	8.9	.
WAS	FDP	3	A2	8.2	.
WAS	FDP	3	A3	7.3	.
WAS	FDP	3	A4	9.3	.
WAS	FDP	3	B1	9.1	.
WAS	FDP	3	B2	9.5	.
WAS	FDP	3	B3	9.7	.
WAS	FDP	3	B4	9.4	.
WAS	FDP	4	A1	9.6	.
WAS	FDP	4	A2	8.6	.
WAS	FDP	4	A3	9.4	.
WAS	FDP	4	A4	9.0	.
WAS	FDP	4	B1	8.6	.
WAS	FDP	4	B2	8.4	.
WAS	FDP	4	B3	8.2	.
WAS	FDP	4	B4	8.6	.
WAS	FDP	5	A1	8.9	.
WAS	FDP	5	A2	8.4	.
WAS	FDP	5	A3	8.4	.
WAS	FDP	5	A4	9.2	.

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WAS	FDP	5	B1	8.6	.
WAS	FDP	5	B2	7.4	.
WAS	FDP	5	B3	8.0	.
WAS	FDP	5	B4	9.2	.
WAS	FDP	6	A1	8.6	.
WAS	FDP	6	A2	7.6	.
WAS	FDP	6	A3	9.1	0.0
WAS	FDP	6	A4	8.8	.
WAS	FDP	6	B1	8.9	.
WAS	FDP	6	B2	8.8	.
WAS	FDP	6	B3	9.2	.
WAS	FDP	6	B4	8.2	.
WAS	FDP	7	A1	10.0	4.0
WAS	FDP	7	A2	8.6	.
WAS	FDP	7	A3	9.1	.
WAS	FDP	7	A4	9.0	.
WAS	FDP	7	B1	9.8	4.8
WAS	FDP	7	B2	8.2	.
WAS	FDP	7	B3	7.9	.
WAS	FDP	7	B4	7.5	.

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FF # 18
Item No. 1
Pg 20 of 20

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical Analysis of Holding Chamber Flow Rates
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW KW

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Obs	sps	form	day	id	fflow	oflow
1	BLS	SDP	-2	A1	8.0	.
2	BLS	SDP	-2	A10	8.4	.
3	BLS	SDP	-2	A11	7.8	.
4	BLS	SDP	-2	A12	8.2	.
5	BLS	SDP	-2	A2	8.2	.
6	BLS	SDP	-2	A3	8.6	.
7	BLS	SDP	-2	A4	7.4	.
8	BLS	SDP	-2	A5	8.4	.
9	BLS	SDP	-2	A6	8.6	.
10	BLS	SDP	-2	A7	7.8	.
11	BLS	SDP	-2	A8	8.6	.
12	BLS	SDP	-2	A9	8.2	.
13	BLS	SDP	-2	B1	7.8	.
14	BLS	SDP	-2	B10	8.2	.
15	BLS	SDP	-2	B11	9.0	.
16	BLS	SDP	-2	B12	8.9	.
17	BLS	SDP	-2	B2	8.2	.
18	BLS	SDP	-2	B3	9.2	.
19	BLS	SDP	-2	B4	8.7	.
20	BLS	SDP	-2	B5	8.7	.
21	BLS	SDP	-2	B6	8.5	.
22	BLS	SDP	-2	B7	8.6	.
23	BLS	SDP	-2	B8	8.1	.
24	BLS	SDP	-2	B9	8.4	.
25	BLS	SDP	-1	A1	9.2	.
26	BLS	SDP	-1	A10	9.3	.
27	BLS	SDP	-1	A11	9.1	.
28	BLS	SDP	-1	A12	9.5	.
29	BLS	SDP	-1	A2	7.7	.
30	BLS	SDP	-1	A3	8.8	.

FF # 18
Item No. 2
Pg 1 of 32

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31	BLS	SDP	-1	A4	8.4	.
32	BLS	SDP	-1	A5	9.0	.
33	BLS	SDP	-1	A6	8.3	.
34	BLS	SDP	-1	A7	9.4	4.0
35	BLS	SDP	-1	A8	9.4	.
36	BLS	SDP	-1	A9	9.4	.
37	BLS	SDP	-1	B1	9.0	.
38	BLS	SDP	-1	B10	9.2	.
39	BLS	SDP	-1	B11	9.3	.
40	BLS	SDP	-1	B12	9.4	.
41	BLS	SDP	-1	B2	8.6	.
42	BLS	SDP	-1	B3	9.2	5.8
43	BLS	SDP	-1	B4	9.4	.
44	BLS	SDP	-1	B5	9.8	.
45	BLS	SDP	-1	B6	9.0	.
46	BLS	SDP	-1	B7	9.0	.
47	BLS	SDP	-1	B8	8.3	.
48	BLS	SDP	-1	B9	8.6	.
49	BLS	SDP	0	A1	7.2	.
50	BLS	SDP	0	A10	7.7	.
51	BLS	SDP	0	A11	7.8	.
52	BLS	SDP	0	A12	7.4	.
53	BLS	SDP	0	A2	7.5	.
54	BLS	SDP	0	A3	7.6	.
55	BLS	SDP	0	A4	7.6	.
56	BLS	SDP	0	A5	7.2	.
57	BLS	SDP	0	A6	7.6	.
58	BLS	SDP	0	A7	7.3	.
59	BLS	SDP	0	A8	7.4	.
60	BLS	SDP	0	A9	7.8	.
61	BLS	SDP	0	B1	7.0	.
62	BLS	SDP	0	B10	7.6	.
63	BLS	SDP	0	B11	8.0	.
64	BLS	SDP	0	B12	8.0	.
65	BLS	SDP	0	B2	7.6	.

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	BLS	SDP	0	B3	7.6	.
67	BLS	SDP	0	B4	8.5	.
68	BLS	SDP	0	B5	8.2	.
69	BLS	SDP	0	B6	8.1	.
70	BLS	SDP	0	B7	8.1	.
71	BLS	SDP	0	B8	7.7	.
72	BLS	SDP	0	B9	7.8	.
73	BLS	SDP	1	A1	7.8	.
74	BLS	SDP	1	A2	9.1	.
75	BLS	SDP	1	A3	9.0	.
76	BLS	SDP	1	A4	9.4	.
77	BLS	SDP	1	B1	9.4	.
78	BLS	SDP	1	B2	9.0	.
79	BLS	SDP	1	B3	9.1	.
80	BLS	SDP	1	B4	8.6	.
81	BLS	SDP	2	A1	9.5	.
82	BLS	SDP	2	A2	8.9	.
83	BLS	SDP	2	A3	9.0	.
84	BLS	SDP	2	A4	9.2	.
85	BLS	SDP	2	B1	9.1	.
86	BLS	SDP	2	B2	9.2	.
87	BLS	SDP	2	B3	9.1	.
88	BLS	SDP	2	B4	9.4	.
89	BLS	SDP	3	A1	8.4	.
90	BLS	SDP	3	A2	9.4	.
91	BLS	SDP	3	A3	8.9	.
92	BLS	SDP	3	A4	9.3	.
93	BLS	SDP	3	B1	8.6	.
94	BLS	SDP	3	B2	8.6	.
95	BLS	SDP	3	B3	8.7	.
96	BLS	SDP	3	B4	9.6	.
97	BLS	SDP	4	A1	7.4	.
98	BLS	SDP	4	A2	8.2	.
99	BLS	SDP	4	A3	9.0	.
100	BLS	SDP	4	A4	9.1	.

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	BLS	SDP	4	B1	9.2	.
102	BLS	SDP	4	B2	8.8	.
103	BLS	SDP	4	B3	8.6	.
104	BLS	SDP	4	B4	8.4	.
105	BLS	SDP	5	A1	9.4	.
106	BLS	SDP	5	A2	8.3	.
107	BLS	SDP	5	A3	9.4	.
108	BLS	SDP	5	A4	9.2	.
109	BLS	SDP	5	B1	9.0	.
110	BLS	SDP	5	B2	9.4	.
111	BLS	SDP	5	B3	9.4	.
112	BLS	SDP	5	B4	9.5	.
113	BLS	SDP	6	A1	8.7	.
114	BLS	SDP	6	A2	8.3	.
115	BLS	SDP	6	A3	9.4	.
116	BLS	SDP	6	A4	9.8	.
117	BLS	SDP	6	B1	8.4	.
118	BLS	SDP	6	B2	9.0	.
119	BLS	SDP	6	B3	9.2	.
120	BLS	SDP	6	B4	9.8	.
121	BLS	SDP	7	A1	10.0	.
122	BLS	SDP	7	A2	9.0	.
123	BLS	SDP	7	A3	9.6	.
124	BLS	SDP	7	A4	8.2	.
125	BLS	SDP	7	B1	7.3	.
126	BLS	SDP	7	B2	9.4	.
127	BLS	SDP	7	B3	9.3	.
128	BLS	SDP	7	B4	9.6	.
129	FAM	SDP	-2	A1	8.8	.
130	FAM	SDP	-2	A10	8.0	.
131	FAM	SDP	-2	A11	8.8	.
132	FAM	SDP	-2	A12	7.8	.
133	FAM	SDP	-2	A2	8.2	.
134	FAM	SDP	-2	A3	8.0	.
135	FAM	SDP	-2	A4	7.4	.

	FAM	SDP	-2	A5	7.6	.
137	FAM	SDP	-2	A6	7.6	.
138	FAM	SDP	-2	A7	8.0	.
139	FAM	SDP	-2	A8	8.0	.
140	FAM	SDP	-2	A9	7.8	.
141	FAM	SDP	-2	B1	8.0	.
142	FAM	SDP	-2	B10	7.6	.
143	FAM	SDP	-2	B11	8.4	.
144	FAM	SDP	-2	B12	8.6	.
145	FAM	SDP	-2	B2	7.4	.
146	FAM	SDP	-2	B3	7.8	.
147	FAM	SDP	-2	B4	8.4	.
148	FAM	SDP	-2	B5	9.0	.
149	FAM	SDP	-2	B6	7.8	.
150	FAM	SDP	-2	B7	8.2	.
151	FAM	SDP	-2	B8	7.8	.
152	FAM	SDP	-2	B9	8.6	.
153	FAM	SDP	-1	A1	8.4	.
154	FAM	SDP	-1	A10	8.6	.
155	FAM	SDP	-1	A11	7.3	.
156	FAM	SDP	-1	A12	8.1	.
157	FAM	SDP	-1	A2	8.2	.
158	FAM	SDP	-1	A3	8.4	.
159	FAM	SDP	-1	A4	7.2	.
160	FAM	SDP	-1	A5	8.0	.
161	FAM	SDP	-1	A6	7.5	.
162	FAM	SDP	-1	A7	8.8	.
163	FAM	SDP	-1	A8	8.1	.
164	FAM	SDP	-1	A9	8.5	.
165	FAM	SDP	-1	B1	8.5	.
166	FAM	SDP	-1	B10	7.9	.
167	FAM	SDP	-1	B11	8.2	.
168	FAM	SDP	-1	B12	8.0	.
169	FAM	SDP	-1	B2	8.0	.
170	FAM	SDP	-1	B3	8.1	.

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	FAM	SDP	-1	B4	9.4	.
172	FAM	SDP	-1	B5	8.2	.
173	FAM	SDP	-1	B6	8.4	6.1
174	FAM	SDP	-1	B7	8.0	.
175	FAM	SDP	-1	B8	8.0	.
176	FAM	SDP	-1	B9	8.2	.
177	FAM	SDP	0	A1	8.4	.
178	FAM	SDP	0	A10	8.4	.
179	FAM	SDP	0	A11	9.0	6.0
180	FAM	SDP	0	A12	8.4	.
181	FAM	SDP	0	A2	9.2	.
182	FAM	SDP	0	A3	8.6	.
183	FAM	SDP	0	A4	8.0	.
184	FAM	SDP	0	A5	8.0	.
185	FAM	SDP	0	A6	7.4	.
186	FAM	SDP	0	A7	8.6	.
187	FAM	SDP	0	A8	8.4	.
188	FAM	SDP	0	A9	8.8	.
189	FAM	SDP	0	B1	8.2	.
190	FAM	SDP	0	B10	8.2	.
191	FAM	SDP	0	B11	8.3	.
192	FAM	SDP	0	B12	9.0	.
193	FAM	SDP	0	B2	8.3	.
194	FAM	SDP	0	B3	8.4	.
195	FAM	SDP	0	B4	9.6	.
196	FAM	SDP	0	B5	8.3	.
197	FAM	SDP	0	B6	8.5	.
198	FAM	SDP	0	B7	8.3	.
199	FAM	SDP	0	B8	7.1	.
200	FAM	SDP	0	B9	7.7	.
201	FAM	SDP	1	A1	8.5	.
202	FAM	SDP	1	A2	8.6	.
203	FAM	SDP	1	A3	9.0	.
204	FAM	SDP	1	A4	7.8	.
205	FAM	SDP	1	B1	9.3	.

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	FAM	SDP	1	B2	8.2	.
207	FAM	SDP	1	B3	8.4	.
208	FAM	SDP	1	B4	9.6	.
209	FAM	SDP	1	B5	7.5	5.0
210	FAM	SDP	2	A1	7.7	.
211	FAM	SDP	2	A2	8.0	.
212	FAM	SDP	2	A3	7.7	.
213	FAM	SDP	2	A4	8.1	.
214	FAM	SDP	2	B1	7.8	.
215	FAM	SDP	2	B2	8.7	.
216	FAM	SDP	2	B3	8.5	.
217	FAM	SDP	2	B4	9.4	6.8
218	FAM	SDP	3	A1	7.2	.
219	FAM	SDP	3	A2	9.5	6.5
220	FAM	SDP	3	A3	7.5	.
221	FAM	SDP	3	A4	10.6	6.4
222	FAM	SDP	3	B1	7.2	.
223	FAM	SDP	3	B2	9.0	6.6
224	FAM	SDP	3	B3	7.3	.
225	FAM	SDP	3	B4	7.3	.
226	FAM	SDP	4	A1	8.2	.
227	FAM	SDP	4	A2	8.7	.
228	FAM	SDP	4	A3	8.8	.
229	FAM	SDP	4	A4	7.3	.
230	FAM	SDP	4	B1	8.8	.
231	FAM	SDP	4	B2	8.2	.
232	FAM	SDP	4	B3	9.8	3.5
233	FAM	SDP	4	B4	9.0	.
234	FAM	SDP	5	A1	8.5	6.8
235	FAM	SDP	5	A2	8.0	.
236	FAM	SDP	5	A3	7.8	.
237	FAM	SDP	5	A4	7.7	.
238	FAM	SDP	5	B1	8.2	6.6
239	FAM	SDP	5	B2	7.5	.
240	FAM	SDP	5	B3	8.6	.

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	FAM	SDP	5	B4	9.3	.
242	FAM	SDP	6	A1	8.8	.
243	FAM	SDP	6	A2	9.4	.
244	FAM	SDP	6	A3	8.6	.
245	FAM	SDP	6	A4	9.8	.
246	FAM	SDP	6	B1	8.6	.
247	FAM	SDP	6	B2	8.8	.
248	FAM	SDP	6	B3	8.6	.
249	FAM	SDP	6	B4	8.7	.
250	FAM	SDP	7	A1	8.0	.
251	FAM	SDP	7	A2	8.6	.
252	FAM	SDP	7	A3	8.2	.
253	FAM	SDP	7	A4	8.4	.
254	FAM	SDP	7	B1	8.6	.
255	FAM	SDP	7	B2	7.8	.
256	FAM	SDP	7	B3	9.4	.
257	FAM	SDP	7	B4	8.6	.
258	HGE	SDP	-2	A1	7.8	.
259	HGE	SDP	-2	A10	8.6	6.7
260	HGE	SDP	-2	A11	7.9	.
261	HGE	SDP	-2	A12	8.8	.
262	HGE	SDP	-2	A2	7.9	.
263	HGE	SDP	-2	A3	7.9	.
264	HGE	SDP	-2	A4	9.0	6.8
265	HGE	SDP	-2	A5	7.3	.
266	HGE	SDP	-2	A6	7.9	.
267	HGE	SDP	-2	A7	7.8	.
268	HGE	SDP	-2	A8	7.3	6.4
269	HGE	SDP	-2	A9	7.4	.
270	HGE	SDP	-2	B1	7.6	.
271	HGE	SDP	-2	B10	7.8	.
272	HGE	SDP	-2	B11	7.4	.
273	HGE	SDP	-2	B12	7.2	.
274	HGE	SDP	-2	B2	7.4	.
275	HGE	SDP	-2	B3	8.4	.

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	HGE	SDP	-2	B4	8.2	.
277	HGE	SDP	-2	B5	8.2	.
278	HGE	SDP	-2	B6	7.3	.
279	HGE	SDP	-2	B7	8.1	.
280	HGE	SDP	-2	B8	8.0	.
281	HGE	SDP	-2	B9	8.1	.
282	HGE	SDP	-1	A1	9.2	.
283	HGE	SDP	-1	A10	9.0	.
284	HGE	SDP	-1	A11	7.7	.
285	HGE	SDP	-1	A12	8.9	.
286	HGE	SDP	-1	A2	9.0	.
287	HGE	SDP	-1	A3	8.8	.
288	HGE	SDP	-1	A4	9.4	.
289	HGE	SDP	-1	A5	8.8	.
290	HGE	SDP	-1	A6	8.6	.
291	HGE	SDP	-1	A7	9.0	.
292	HGE	SDP	-1	A8	9.0	6.8
293	HGE	SDP	-1	A9	8.6	.
294	HGE	SDP	-1	B1	7.0	.
295	HGE	SDP	-1	B10	9.0	.
296	HGE	SDP	-1	B11	8.4	.
297	HGE	SDP	-1	B12	9.8	5.8
298	HGE	SDP	-1	B2	9.1	5.5
299	HGE	SDP	-1	B3	9.0	.
300	HGE	SDP	-1	B4	9.0	.
301	HGE	SDP	-1	B5	9.2	.
302	HGE	SDP	-1	B6	9.1	.
303	HGE	SDP	-1	B7	8.9	6.2
304	HGE	SDP	-1	B8	9.4	5.7
305	HGE	SDP	-1	B9	9.0	6.2
306	HGE	SDP	0	A1	8.3	.
307	HGE	SDP	0	A10	9.0	.
308	HGE	SDP	0	A11	7.3	.
309	HGE	SDP	0	A12	9.4	.
310	HGE	SDP	0	A2	9.8	.

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	HGE	SDP	0	A3	8.5	.
312	HGE	SDP	0	A4	9.5	.
313	HGE	SDP	0	A5	8.6	.
314	HGE	SDP	0	A6	8.2	.
315	HGE	SDP	0	A7	8.8	.
316	HGE	SDP	0	A8	8.0	.
317	HGE	SDP	0	A9	9.3	.
318	HGE	SDP	0	B1	9.1	6.6
319	HGE	SDP	0	B10	8.8	.
320	HGE	SDP	0	B11	8.2	.
321	HGE	SDP	0	B12	8.8	.
322	HGE	SDP	0	B2	10.4	5.1
323	HGE	SDP	0	B3	8.8	.
324	HGE	SDP	0	B4	9.4	.
325	HGE	SDP	0	B5	9.0	6.9
326	HGE	SDP	0	B6	9.0	.
327	HGE	SDP	0	B7	8.3	.
328	HGE	SDP	0	B8	9.1	.
329	HGE	SDP	0	B9	9.0	.
330	HGE	SDP	1	A1	8.6	.
331	HGE	SDP	1	A2	9.0	.
332	HGE	SDP	1	A3	8.1	.
333	HGE	SDP	1	A4	9.0	.
334	HGE	SDP	1	B1	9.5	.
335	HGE	SDP	1	B2	8.9	.
336	HGE	SDP	1	B3	8.0	.
337	HGE	SDP	1	B4	8.8	.
338	HGE	SDP	2	A1	7.8	.
339	HGE	SDP	2	A2	8.8	.
340	HGE	SDP	2	A3	10.0	.
341	HGE	SDP	2	A4	9.0	.
342	HGE	SDP	2	B1	9.1	.
343	HGE	SDP	2	B2	8.6	.
344	HGE	SDP	2	B3	9.2	.
345	HGE	SDP	2	B4	9.3	.

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	HGE	SDP	3	A1	8.4	.
347	HGE	SDP	3	A2	9.0	.
348	HGE	SDP	3	A3	8.6	.
349	HGE	SDP	3	A4	9.7	.
350	HGE	SDP	3	B1	9.0	.
351	HGE	SDP	3	B2	9.6	.
352	HGE	SDP	3	B3	8.5	.
353	HGE	SDP	3	B4	9.0	.
354	HGE	SDP	4	A1	9.6	.
355	HGE	SDP	4	A2	8.3	.
356	HGE	SDP	4	A3	8.3	.
357	HGE	SDP	4	A4	8.5	.
358	HGE	SDP	4	B1	8.1	.
359	HGE	SDP	4	B2	8.8	.
360	HGE	SDP	4	B3	9.0	.
361	HGE	SDP	4	B4	8.8	.
362	HGE	SDP	5	A1	7.3	.
363	HGE	SDP	5	A2	8.5	.
364	HGE	SDP	5	A3	8.8	.
365	HGE	SDP	5	A4	8.2	.
366	HGE	SDP	5	B1	7.5	.
367	HGE	SDP	5	B2	8.7	.
368	HGE	SDP	5	B3	8.0	.
369	HGE	SDP	5	B4	9.5	.
370	HGE	SDP	6	A1	8.0	.
371	HGE	SDP	6	A2	9.3	.
372	HGE	SDP	6	A3	8.0	.
373	HGE	SDP	6	A4	9.9	.
374	HGE	SDP	6	B1	8.8	.
375	HGE	SDP	6	B2	9.4	.
376	HGE	SDP	6	B3	8.0	.
377	HGE	SDP	6	B4	8.4	.
378	HGE	SDP	7	A1	8.1	.
379	HGE	SDP	7	A2	8.9	.
380	HGE	SDP	7	A3	8.8	.

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	HGE	SDP	7	A4	8.4	.
382	HGE	SDP	7	B1	9.6	.
383	HGE	SDP	7	B2	8.1	.
384	HGE	SDP	7	B3	8.4	.
385	HGE	SDP	7	B4	8.8	.
386	HIC	FDP	-2	A1	8.8	.
387	HIC	FDP	-2	A10	8.9	.
388	HIC	FDP	-2	A11	9.0	.
389	HIC	FDP	-2	A12	8.9	.
390	HIC	FDP	-2	A2	8.8	.
391	HIC	FDP	-2	A3	8.2	.
392	HIC	FDP	-2	A4	7.5	.
393	HIC	FDP	-2	A5	9.4	.
394	HIC	FDP	-2	A6	7.5	.
395	HIC	FDP	-2	A7	8.6	.
396	HIC	FDP	-2	A8	7.6	.
397	HIC	FDP	-2	A9	9.8	.
398	HIC	FDP	-2	B1	9.2	.
399	HIC	FDP	-2	B10	9.8	.
400	HIC	FDP	-2	B11	9.4	.
401	HIC	FDP	-2	B12	8.4	.
402	HIC	FDP	-2	B2	7.8	.
403	HIC	FDP	-2	B3	8.9	.
404	HIC	FDP	-2	B4	8.7	.
405	HIC	FDP	-2	B5	8.4	.
406	HIC	FDP	-2	B6	8.6	.
407	HIC	FDP	-2	B7	9.4	.
408	HIC	FDP	-2	B8	8.8	.
409	HIC	FDP	-2	B9	8.0	.
410	HIC	FDP	-1	A1	8.8	.
411	HIC	FDP	-1	A2	8.2	.
412	HIC	FDP	-1	A3	8.6	.
413	HIC	FDP	-1	A4	9.3	.
414	HIC	FDP	-1	B1	9.2	.
415	HIC	FDP	-1	B2	8.1	.

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	HIC	FDP	-1	B3	8.6	.
417	HIC	FDP	-1	B4	8.9	.
418	HIC	FDP	0	A1	9.0	.
419	HIC	FDP	0	A10	9.0	.
420	HIC	FDP	0	A11	9.2	5.0
421	HIC	FDP	0	A12	8.8	.
422	HIC	FDP	0	A2	8.2	.
423	HIC	FDP	0	A3	7.8	.
424	HIC	FDP	0	A4	9.1	.
425	HIC	FDP	0	A5	9.4	.
426	HIC	FDP	0	A6	9.0	.
427	HIC	FDP	0	A7	8.9	.
428	HIC	FDP	0	A8	8.1	.
429	HIC	FDP	0	A9	9.4	.
430	HIC	FDP	0	B1	9.2	.
431	HIC	FDP	0	B10	9.8	.
432	HIC	FDP	0	B11	9.0	.
433	HIC	FDP	0	B12	8.7	.
434	HIC	FDP	0	B2	8.2	.
435	HIC	FDP	0	B3	9.3	.
436	HIC	FDP	0	B4	9.1	.
437	HIC	FDP	0	B5	8.2	.
438	HIC	FDP	0	B6	8.6	.
439	HIC	FDP	0	B7	9.8	.
440	HIC	FDP	0	B8	9.0	.
441	HIC	FDP	0	B9	8.6	.
442	HIC	FDP	1	A1	9.3	.
443	HIC	FDP	1	A2	9.1	.
444	HIC	FDP	1	A3	9.0	.
445	HIC	FDP	1	A4	8.2	.
446	HIC	FDP	1	B1	8.6	.
447	HIC	FDP	1	B2	8.4	.
448	HIC	FDP	1	B3	9.7	.
449	HIC	FDP	1	B4	9.6	.
450	HIC	FDP	2	A1	9.4	.

	HIC	FDP	2	A2	8.8	.
452	HIC	FDP	2	A3	9.0	.
453	HIC	FDP	2	A4	8.8	.
454	HIC	FDP	2	B1	8.3	.
455	HIC	FDP	2	B2	9.6	.
456	HIC	FDP	2	B3	8.6	.
457	HIC	FDP	2	B4	8.6	.
458	HIC	FDP	3	A1	8.6	.
459	HIC	FDP	3	A2	8.4	.
460	HIC	FDP	3	A3	7.8	.
461	HIC	FDP	3	A4	8.4	.
462	HIC	FDP	3	B1	8.3	.
463	HIC	FDP	3	B2	8.6	.
464	HIC	FDP	3	B3	9.0	.
465	HIC	FDP	3	B4	8.6	.
466	HIC	FDP	4	A1	9.0	.
467	HIC	FDP	4	A2	8.7	.
468	HIC	FDP	4	A3	8.4	.
469	HIC	FDP	4	A4	8.7	.
470	HIC	FDP	4	B1	8.3	.
471	HIC	FDP	4	B2	8.3	.
472	HIC	FDP	4	B3	9.4	.
473	HIC	FDP	4	B4	9.3	.
474	HIC	FDP	5	A1	8.8	.
475	HIC	FDP	5	A2	9.3	.
476	HIC	FDP	5	A3	8.7	.
477	HIC	FDP	5	A4	8.8	.
478	HIC	FDP	5	B1	8.3	.
479	HIC	FDP	5	B2	9.7	.
480	HIC	FDP	5	B3	9.2	.
481	HIC	FDP	5	B4	8.4	.
482	HIC	FDP	6	A1	8.3	.
483	HIC	FDP	6	A2	8.1	.
484	HIC	FDP	6	A3	7.5	.
485	HIC	FDP	6	A4	7.9	.

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	HIC	FDP	6	B1	8.1	.
487	HIC	FDP	6	B2	8.0	.
488	HIC	FDP	6	B3	8.7	.
489	HIC	FDP	6	B4	8.6	.
490	HIC	FDP	7	A1	8.6	.
491	HIC	FDP	7	A2	8.6	.
492	HIC	FDP	7	A3	8.2	.
493	HIC	FDP	7	A4	8.6	.
494	HIC	FDP	7	B1	8.0	.
495	HIC	FDP	7	B2	8.3	.
496	HIC	FDP	7	B3	9.1	.
497	HIC	FDP	7	B4	8.9	.
498	MUC	FDP	-2	A1	8.6	.
499	MUC	FDP	-2	A10	9.2	.
500	MUC	FDP	-2	A11	8.6	.
501	MUC	FDP	-2	A12	8.9	.
502	MUC	FDP	-2	A2	7.6	.
503	MUC	FDP	-2	A3	9.2	.
504	MUC	FDP	-2	A4	8.0	.
505	MUC	FDP	-2	A5	8.4	.
506	MUC	FDP	-2	A6	8.3	.
507	MUC	FDP	-2	A7	8.9	.
508	MUC	FDP	-2	A8	8.7	.
509	MUC	FDP	-2	A9	8.7	.
510	MUC	FDP	-2	B1	9.8	.
511	MUC	FDP	-2	B10	8.6	.
512	MUC	FDP	-2	B11	9.0	.
513	MUC	FDP	-2	B12	9.9	.
514	MUC	FDP	-2	B2	9.2	.
515	MUC	FDP	-2	B3	9.6	.
516	MUC	FDP	-2	B4	10.0	.
517	MUC	FDP	-2	B5	10.4	.
518	MUC	FDP	-2	B6	10.0	.
519	MUC	FDP	-2	B7	9.9	.
520	MUC	FDP	-2	B8	9.9	.

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	MUC	FDP	-2	B9	9.6	.
522	MUC	FDP	-1	A1	9.2	.
523	MUC	FDP	-1	A2	8.5	.
524	MUC	FDP	-1	A3	9.4	.
525	MUC	FDP	-1	A4	8.9	.
526	MUC	FDP	-1	B1	9.6	.
527	MUC	FDP	-1	B2	9.2	.
528	MUC	FDP	-1	B3	9.2	.
529	MUC	FDP	-1	B4	10.3	.
530	MUC	FDP	0	A1	8.6	.
531	MUC	FDP	0	A10	9.5	.
532	MUC	FDP	0	A11	9.5	.
533	MUC	FDP	0	A12	10.0	.
534	MUC	FDP	0	A2	8.8	.
535	MUC	FDP	0	A3	9.5	.
536	MUC	FDP	0	A4	9.4	.
537	MUC	FDP	0	A5	8.8	.
538	MUC	FDP	0	A6	8.7	.
539	MUC	FDP	0	A7	9.8	.
540	MUC	FDP	0	A8	8.6	.
541	MUC	FDP	0	A9	9.2	.
542	MUC	FDP	0	B1	9.7	.
543	MUC	FDP	0	B10	8.4	.
544	MUC	FDP	0	B11	9.6	.
545	MUC	FDP	0	B12	9.3	.
546	MUC	FDP	0	B2	9.4	.
547	MUC	FDP	0	B3	9.8	.
548	MUC	FDP	0	B4	10.2	.
549	MUC	FDP	0	B5	10.6	.
550	MUC	FDP	0	B6	10.5	.
551	MUC	FDP	0	B7	8.8	.
552	MUC	FDP	0	B8	10.2	.
553	MUC	FDP	0	B9	9.4	.
554	MUC	FDP	1	A1	8.6	.
555	MUC	FDP	1	A2	8.3	.

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	MUC	FDP	1	A3	9.4	.
557	MUC	FDP	1	A4	9.6	.
558	MUC	FDP	1	B1	9.4	.
559	MUC	FDP	1	B2	9.2	.
560	MUC	FDP	1	B3	9.6	.
561	MUC	FDP	1	B4	10.0	.
562	MUC	FDP	2	A1	8.6	.
563	MUC	FDP	2	A2	8.8	.
564	MUC	FDP	2	A3	9.6	.
565	MUC	FDP	2	A4	9.0	.
566	MUC	FDP	2	B1	10.4	.
567	MUC	FDP	2	B2	10.3	.
568	MUC	FDP	2	B3	9.4	.
569	MUC	FDP	2	B4	10.0	.
570	MUC	FDP	3	A1	9.1	.
571	MUC	FDP	3	A2	9.6	.
572	MUC	FDP	3	A3	9.4	.
573	MUC	FDP	3	A4	10.2	.
574	MUC	FDP	3	B1	7.6	.
575	MUC	FDP	3	B2	8.6	.
576	MUC	FDP	3	B3	9.6	.
577	MUC	FDP	3	B4	9.7	.
578	MUC	FDP	4	A1	7.2	.
579	MUC	FDP	4	A2	8.6	.
580	MUC	FDP	4	A3	9.2	.
581	MUC	FDP	4	A4	9.1	.
582	MUC	FDP	4	B1	9.1	.
583	MUC	FDP	4	B2	9.2	.
584	MUC	FDP	4	B3	9.1	.
585	MUC	FDP	4	B4	9.6	.
586	MUC	FDP	5	A1	8.0	.
587	MUC	FDP	5	A2	9.2	.
588	MUC	FDP	5	A3	8.9	.
589	MUC	FDP	5	A4	8.8	.
590	MUC	FDP	5	B1	9.2	.

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	MUC	FDP	5	B2	10.2	.
592	MUC	FDP	5	B3	9.9	.
593	MUC	FDP	5	B4	9.6	.
594	MUC	FDP	6	A1	8.5	.
595	MUC	FDP	6	A2	9.4	.
596	MUC	FDP	6	A3	8.3	.
597	MUC	FDP	6	A4	9.8	.
598	MUC	FDP	6	B1	9.2	.
599	MUC	FDP	6	B2	8.8	.
600	MUC	FDP	6	B3	8.2	.
601	MUC	FDP	6	B4	9.2	.
602	MUC	FDP	7	A1	6.0	.
603	MUC	FDP	7	A2	8.1	.
604	MUC	FDP	7	A3	9.2	.
605	MUC	FDP	7	A4	8.8	.
606	MUC	FDP	7	B1	9.0	.
607	MUC	FDP	7	B2	8.9	.
608	MUC	FDP	7	B3	9.2	.
609	MUC	FDP	7	B4	9.5	.
610	PPB	SDP	-2	A1	7.8	.
611	PPB	SDP	-2	A10	8.4	.
612	PPB	SDP	-2	A11	8.2	.
613	PPB	SDP	-2	A12	7.6	.
614	PPB	SDP	-2	A2	7.9	.
615	PPB	SDP	-2	A3	7.6	.
616	PPB	SDP	-2	A4	8.3	.
617	PPB	SDP	-2	A5	7.4	.
618	PPB	SDP	-2	A6	7.8	.
619	PPB	SDP	-2	A7	8.2	.
620	PPB	SDP	-2	A8	8.0	.
621	PPB	SDP	-2	A9	7.4	.
622	PPB	SDP	-2	B1	8.3	.
623	PPB	SDP	-2	B10	8.1	.
624	PPB	SDP	-2	B11	8.7	.
625	PPB	SDP	-2	B12	8.3	.

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	PPB	SDP	-2	B2	8.0	.
627	PPB	SDP	-2	B3	8.0	.
628	PPB	SDP	-2	B4	8.6	.
629	PPB	SDP	-2	B5	7.2	.
630	PPB	SDP	-2	B6	8.1	.
631	PPB	SDP	-2	B7	7.9	.
632	PPB	SDP	-2	B8	8.0	.
633	PPB	SDP	-2	B9	8.3	.
634	PPB	SDP	-1	A1	8.1	.
635	PPB	SDP	-1	A10	8.4	.
636	PPB	SDP	-1	A11	8.4	.
637	PPB	SDP	-1	A12	8.0	.
638	PPB	SDP	-1	A2	8.0	.
639	PPB	SDP	-1	A3	7.6	.
640	PPB	SDP	-1	A4	8.0	.
641	PPB	SDP	-1	A5	7.4	.
642	PPB	SDP	-1	A6	7.9	.
643	PPB	SDP	-1	A7	7.8	.
644	PPB	SDP	-1	A8	7.2	.
645	PPB	SDP	-1	A9	8.2	.
646	PPB	SDP	-1	B1	8.2	.
647	PPB	SDP	-1	B10	7.9	.
648	PPB	SDP	-1	B11	8.4	.
649	PPB	SDP	-1	B12	8.5	.
650	PPB	SDP	-1	B2	7.9	.
651	PPB	SDP	-1	B3	7.8	.
652	PPB	SDP	-1	B4	8.5	.
653	PPB	SDP	-1	B5	7.9	.
654	PPB	SDP	-1	B6	7.7	.
655	PPB	SDP	-1	B7	8.4	.
656	PPB	SDP	-1	B8	7.8	.
657	PPB	SDP	-1	B9	8.1	.
658	PPB	SDP	0	A1	8.0	.
659	PPB	SDP	0	A10	8.0	.
660	PPB	SDP	0	A11	8.5	.

	PPB	SDP	0	A12	8.0	.
662	PPB	SDP	0	A2	8.6	.
663	PPB	SDP	0	A3	7.0	.
664	PPB	SDP	0	A4	8.2	.
665	PPB	SDP	0	A5	7.4	.
666	PPB	SDP	0	A6	7.8	.
667	PPB	SDP	0	A7	8.0	.
668	PPB	SDP	0	A8	7.5	.
669	PPB	SDP	0	A9	8.8	.
670	PPB	SDP	0	B1	7.8	.
671	PPB	SDP	0	B10	7.6	.
672	PPB	SDP	0	B11	7.9	.
673	PPB	SDP	0	B12	7.4	.
674	PPB	SDP	0	B2	7.4	.
675	PPB	SDP	0	B3	7.3	.
676	PPB	SDP	0	B4	7.7	.
677	PPB	SDP	0	B5	7.8	.
678	PPB	SDP	0	B6	7.2	.
679	PPB	SDP	0	B7	7.8	.
680	PPB	SDP	0	B8	7.0	.
681	PPB	SDP	0	B9	7.5	.
682	PPB	SDP	1	A1	8.2	.
683	PPB	SDP	1	A2	8.6	.
684	PPB	SDP	1	A3	8.1	.
685	PPB	SDP	1	A4	8.4	.
686	PPB	SDP	1	B1	8.0	.
687	PPB	SDP	1	B2	7.8	.
688	PPB	SDP	1	B3	8.0	.
689	PPB	SDP	1	B4	8.4	.
690	PPB	SDP	2	A1	8.4	.
691	PPB	SDP	2	A2	7.7	.
692	PPB	SDP	2	A3	8.4	.
693	PPB	SDP	2	A4	7.6	.
694	PPB	SDP	2	B1	7.4	.
695	PPB	SDP	2	B2	8.4	.

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	PPB	SDP	2	B3	7.7	.
697	PPB	SDP	2	B4	8.3	.
698	PPB	SDP	3	A1	9.4	.
699	PPB	SDP	3	A2	8.2	.
700	PPB	SDP	3	A3	8.4	.
701	PPB	SDP	3	A4	8.0	.
702	PPB	SDP	3	B1	8.6	.
703	PPB	SDP	3	B2	8.0	.
704	PPB	SDP	3	B3	8.3	.
705	PPB	SDP	3	B4	7.6	.
706	PPB	SDP	4	A1	7.8	.
707	PPB	SDP	4	A2	7.4	.
708	PPB	SDP	4	A3	7.8	.
709	PPB	SDP	4	A4	7.8	.
710	PPB	SDP	4	B1	8.4	.
711	PPB	SDP	4	B2	7.4	.
712	PPB	SDP	4	B3	7.7	.
713	PPB	SDP	4	B4	8.1	.
714	PPB	SDP	5	A1	7.1	.
715	PPB	SDP	5	A2	8.0	.
716	PPB	SDP	5	A3	7.9	.
717	PPB	SDP	5	A4	7.3	.
718	PPB	SDP	5	B1	8.2	.
719	PPB	SDP	5	B2	7.4	.
720	PPB	SDP	5	B3	8.3	.
721	PPB	SDP	5	B4	8.2	.
722	PPB	SDP	6	A1	9.5	.
723	PPB	SDP	6	A2	7.4	.
724	PPB	SDP	6	A3	8.4	.
725	PPB	SDP	6	A4	7.8	.
726	PPB	SDP	6	B1	8.3	.
727	PPB	SDP	6	B2	8.0	.
728	PPB	SDP	6	B3	8.3	.
729	PPB	SDP	6	B4	7.5	.
730	PPB	SDP	7	A1	7.6	.

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	PPB	SDP	7	A2	8.3	.
732	PPB	SDP	7	A3	7.6	.
733	PPB	SDP	7	A4	7.8	.
734	PPB	SDP	7	B1	8.2	.
735	PPB	SDP	7	B2	7.3	.
736	PPB	SDP	7	B3	7.7	.
737	PPB	SDP	7	B4	8.2	.
738	WAS	FDP	-2	A1	9.2	.
739	WAS	FDP	-2	A10	8.6	.
740	WAS	FDP	-2	A11	8.2	.
741	WAS	FDP	-2	A12	8.8	.
742	WAS	FDP	-2	A2	8.4	.
743	WAS	FDP	-2	A3	8.2	.
744	WAS	FDP	-2	A4	8.8	.
745	WAS	FDP	-2	A5	9.2	.
746	WAS	FDP	-2	A6	8.2	.
747	WAS	FDP	-2	A7	8.7	.
748	WAS	FDP	-2	A8	8.6	.
749	WAS	FDP	-2	A9	8.4	.
750	WAS	FDP	-2	B1	8.4	.
751	WAS	FDP	-2	B10	8.7	.
752	WAS	FDP	-2	B11	8.7	.
753	WAS	FDP	-2	B12	8.6	.
754	WAS	FDP	-2	B2	8.5	.
755	WAS	FDP	-2	B3	8.8	.
756	WAS	FDP	-2	B4	8.2	.
757	WAS	FDP	-2	B5	8.2	.
758	WAS	FDP	-2	B6	8.0	.
759	WAS	FDP	-2	B7	8.2	.
760	WAS	FDP	-2	B8	7.6	.
761	WAS	FDP	-2	B9	7.9	.
762	WAS	FDP	-1	A1	8.3	6.6
763	WAS	FDP	-1	A10	8.5	.
764	WAS	FDP	-1	A11	7.2	3.8
765	WAS	FDP	-1	A12	8.9	.

	WAS	FDP	-1	A2	8.0	.
767	WAS	FDP	-1	A3	9.1	6.1
768	WAS	FDP	-1	A4	8.0	.
769	WAS	FDP	-1	A5	7.9	.
770	WAS	FDP	-1	A6	8.0	.
771	WAS	FDP	-1	A7	8.3	.
772	WAS	FDP	-1	A8	8.9	.
773	WAS	FDP	-1	A9	8.4	.
774	WAS	FDP	-1	B1	8.5	.
775	WAS	FDP	-1	B10	9.2	.
776	WAS	FDP	-1	B11	8.2	.
777	WAS	FDP	-1	B12	8.2	.
778	WAS	FDP	-1	B2	8.9	0.5
779	WAS	FDP	-1	B3	8.4	.
780	WAS	FDP	-1	B4	9.0	6.3
781	WAS	FDP	-1	B5	8.1	.
782	WAS	FDP	-1	B6	7.9	.
783	WAS	FDP	-1	B7	8.4	.
784	WAS	FDP	-1	B8	8.5	6.8
785	WAS	FDP	-1	B9	9.0	6.4
786	WAS	FDP	0	A1	8.4	.
787	WAS	FDP	0	A10	8.6	.
788	WAS	FDP	0	A11	9.0	.
789	WAS	FDP	0	A12	9.0	.
790	WAS	FDP	0	A2	9.4	.
791	WAS	FDP	0	A3	9.4	.
792	WAS	FDP	0	A4	9.0	.
793	WAS	FDP	0	A5	9.0	.
794	WAS	FDP	0	A6	8.4	.
795	WAS	FDP	0	A7	8.4	.
796	WAS	FDP	0	A8	9.0	.
797	WAS	FDP	0	A9	8.6	.
798	WAS	FDP	0	B1	8.6	.
799	WAS	FDP	0	B10	9.0	.
800	WAS	FDP	0	B11	8.8	.

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	WAS	FDP	0	B12	9.2	.
802	WAS	FDP	0	B2	8.6	.
803	WAS	FDP	0	B3	8.8	.
804	WAS	FDP	0	B4	8.6	.
805	WAS	FDP	0	B5	8.1	.
806	WAS	FDP	0	B6	8.0	.
807	WAS	FDP	0	B7	8.4	.
808	WAS	FDP	0	B8	8.6	.
809	WAS	FDP	0	B9	9.2	.
810	WAS	FDP	1	A1	9.0	.
811	WAS	FDP	1	A2	8.4	.
812	WAS	FDP	1	A3	9.4	.
813	WAS	FDP	1	A4	8.8	.
814	WAS	FDP	1	B1	8.6	.
815	WAS	FDP	1	B2	8.4	.
816	WAS	FDP	1	B3	8.8	.
817	WAS	FDP	1	B4	8.6	.
818	WAS	FDP	2	A1	9.2	.
819	WAS	FDP	2	A2	8.6	.
820	WAS	FDP	2	A3	8.2	.
821	WAS	FDP	2	A4	8.7	.
822	WAS	FDP	2	B1	8.8	.
823	WAS	FDP	2	B2	7.9	.
824	WAS	FDP	2	B3	8.6	.
825	WAS	FDP	2	B4	9.6	.
826	WAS	FDP	3	A1	8.9	.
827	WAS	FDP	3	A2	8.2	.
828	WAS	FDP	3	A3	7.3	.
829	WAS	FDP	3	A4	9.3	.
830	WAS	FDP	3	B1	9.1	.
831	WAS	FDP	3	B2	9.5	.
832	WAS	FDP	3	B3	9.7	.
833	WAS	FDP	3	B4	9.4	.
834	WAS	FDP	4	A1	9.6	.
835	WAS	FDP	4	A2	8.6	.

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	WAS	FDP	4	A3	9.4	.
837	WAS	FDP	4	A4	9.0	.
838	WAS	FDP	4	B1	8.6	.
839	WAS	FDP	4	B2	8.4	.
840	WAS	FDP	4	B3	8.2	.
841	WAS	FDP	4	B4	8.6	.
842	WAS	FDP	5	A1	8.9	.
843	WAS	FDP	5	A2	8.4	.
844	WAS	FDP	5	A3	8.4	.
845	WAS	FDP	5	A4	9.2	.
846	WAS	FDP	5	B1	8.6	.
847	WAS	FDP	5	B2	7.4	.
848	WAS	FDP	5	B3	8.0	.
849	WAS	FDP	5	B4	9.2	.
850	WAS	FDP	6	A1	8.6	.
851	WAS	FDP	6	A2	7.6	.
852	WAS	FDP	6	A3	9.1	0.0
853	WAS	FDP	6	A4	8.8	.
854	WAS	FDP	6	B1	8.9	.
855	WAS	FDP	6	B2	8.8	.
856	WAS	FDP	6	B3	9.2	.
857	WAS	FDP	6	B4	8.2	.
858	WAS	FDP	7	A1	10.0	4.0
859	WAS	FDP	7	A2	8.6	.
860	WAS	FDP	7	A3	9.1	.
861	WAS	FDP	7	A4	9.0	.
862	WAS	FDP	7	B1	9.8	4.8
863	WAS	FDP	7	B2	8.2	.
864	WAS	FDP	7	B3	7.9	.
865	WAS	FDP	7	B4	7.5	.

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Performed by K. Weber SAS version 9.4 09:43 07MAY14 KW

Flow Rate Means by Species and Formulation

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The MEANS Procedure

sps=BLS form=SDP

Analysis Variable : fflow fflow							
day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	8.3542	0.4212	7.4000	9.2000	8.1763	8.5320
-1	24	9.0125	0.4839	7.7000	9.8000	8.8082	9.2168
0	24	7.6792	0.3514	7.0000	8.5000	7.5308	7.8275
1	8	8.9250	0.5203	7.8000	9.4000	8.4900	9.3600
2	8	9.1750	0.1982	8.9000	9.5000	9.0093	9.3407
3	8	8.9375	0.4406	8.4000	9.6000	8.5692	9.3058
4	8	8.5875	0.5915	7.4000	9.2000	8.0930	9.0820
5	8	9.2000	0.3964	8.3000	9.5000	8.8686	9.5314
6	8	9.0750	0.5825	8.3000	9.8000	8.5880	9.5620
7	8	9.0500	0.8848	7.3000	10.0000	8.3103	9.7897

sps=FAM form=SDP

Analysis Variable : fflow fflow							
day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	8.0667	0.4517	7.4000	9.0000	7.8759	8.2574
-1	24	8.1667	0.4594	7.2000	9.4000	7.9727	8.3606
0	24	8.3792	0.5381	7.1000	9.6000	8.1519	8.6064
1	9	8.5444	0.6784	7.5000	9.6000	8.0230	9.0659
2	8	8.2375	0.5951	7.7000	9.4000	7.7400	8.7350
3	8	8.2000	1.3202	7.2000	10.6000	7.0963	9.3037
4	8	8.6000	0.7270	7.3000	9.8000	7.9922	9.2078
5	8	8.2000	0.5855	7.5000	9.3000	7.7105	8.6895
6	8	8.9125	0.4454	8.6000	9.8000	8.5401	9.2849
7	8	8.4500	0.4870	7.8000	9.4000	8.0429	8.8571

sps=HGE form=SDP

Analysis Variable : fflow fflow

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day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	7.8875	0.4875	7.2000	9.0000	7.6816	8.0934
-1	24	8.8708	0.5568	7.0000	9.8000	8.6357	9.1059
0	24	8.8583	0.6433	7.3000	10.4000	8.5867	9.1300
1	8	8.7375	0.4955	8.0000	9.5000	8.3232	9.1518
2	8	8.9750	0.6296	7.8000	10.0000	8.4486	9.5014
3	8	8.9750	0.4803	8.4000	9.7000	8.5734	9.3766
4	8	8.6750	0.4833	8.1000	9.6000	8.2710	9.0790
5	8	8.3125	0.7200	7.3000	9.5000	7.7106	8.9144
6	8	8.7250	0.7421	8.0000	9.9000	8.1046	9.3454
7	8	8.6375	0.4984	8.1000	9.6000	8.2208	9.0542

sps=HIC form=FDP

Analysis Variable : fflow fflow							
day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	8.6833	0.6664	7.5000	9.8000	8.4019	8.9647
-1	8	8.7125	0.4291	8.1000	9.3000	8.3538	9.0712
0	24	8.8917	0.5166	7.8000	9.8000	8.6735	9.1098
1	8	8.9875	0.5489	8.2000	9.7000	8.5286	9.4464
2	8	8.8875	0.4324	8.3000	9.6000	8.5260	9.2490
3	8	8.4625	0.3420	7.8000	9.0000	8.1766	8.7484
4	8	8.7625	0.4340	8.3000	9.4000	8.3996	9.1254
5	8	8.9000	0.4721	8.3000	9.7000	8.5053	9.2947
6	8	8.1500	0.3854	7.5000	8.7000	7.8278	8.4722
7	8	8.5375	0.3623	8.0000	9.1000	8.2346	8.8404

sps=MUC form=FDP

Analysis Variable : fflow fflow							
day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	9.1250	0.7219	7.6000	10.4000	8.8202	9.4298
-1	8	9.2875	0.5249	8.5000	10.3000	8.8487	9.7263
0	24	9.4292	0.6132	8.4000	10.6000	9.1702	9.6881
1	8	9.2625	0.5579	8.3000	10.0000	8.7961	9.7289

AEH-11-PSEUDO-02

2	8	9.5125	0.6833	8.6000	10.4000	8.9412	10.0838
3	8	9.2250	0.8049	7.6000	10.2000	8.5521	9.8979
4	8	8.8875	0.7338	7.2000	9.6000	8.2741	9.5009
5	8	9.2250	0.6902	8.0000	10.2000	8.6479	9.8021
6	8	8.9250	0.5676	8.2000	9.8000	8.4505	9.3995
7	8	8.5875	1.1231	6.0000	9.5000	7.6486	9.5264

sps=PPB form=SDP

Analysis Variable : fflow fflow							
day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	8.0042	0.3759	7.2000	8.7000	7.8454	8.1629
-1	24	8.0042	0.3394	7.2000	8.5000	7.8608	8.1475
0	24	7.7583	0.4671	7.0000	8.8000	7.5611	7.9556
1	8	8.1875	0.2642	7.8000	8.6000	7.9666	8.4084
2	8	7.9875	0.4257	7.4000	8.4000	7.6316	8.3434
3	8	8.3125	0.5330	7.6000	9.4000	7.8669	8.7581
4	8	7.8000	0.3338	7.4000	8.4000	7.5209	8.0791
5	8	7.8000	0.4660	7.1000	8.3000	7.4104	8.1896
6	8	8.1500	0.6612	7.4000	9.5000	7.5972	8.7028
7	8	7.8375	0.3583	7.3000	8.3000	7.5379	8.1371

sps=WAS form=FDP

Analysis Variable : fflow fflow							
day	N Obs	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
-2	24	8.4625	0.3820	7.6000	9.2000	8.3012	8.6238
-1	24	8.4083	0.4772	7.2000	9.2000	8.2068	8.6099
0	24	8.7542	0.3753	8.0000	9.4000	8.5957	8.9126
1	8	8.7500	0.3338	8.4000	9.4000	8.4709	9.0291
2	8	8.7000	0.5318	7.9000	9.6000	8.2554	9.1446
3	8	8.9250	0.8013	7.3000	9.7000	8.2551	9.5949
4	8	8.8000	0.4899	8.2000	9.6000	8.3904	9.2096
5	8	8.5125	0.6128	7.4000	9.2000	8.0002	9.0248
6	8	8.6500	0.5237	7.6000	9.2000	8.2122	9.0878
7	8	8.7625	0.8831	7.5000	10.0000	8.0242	9.5008

Performed by K. Weber SAS version 9.4 09:43 07MAY14 KW

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Flow Rate Means by Species and Formulation

The MEANS Procedure

sps=BLS form=SDP

Analysis Variable : fflow fflow					
Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
8.6305	0.7083	7.0000	10.0000	8.5066	8.7544

sps=FAM form=SDP

Analysis Variable : fflow fflow					
Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
8.3132	0.6263	7.1000	10.6000	8.2041	8.4223

sps=HGE form=SDP

Analysis Variable : fflow fflow					
Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
8.6180	0.6748	7.0000	10.4000	8.4999	8.7360

sps=HIC form=FDP

Analysis Variable : fflow fflow					
Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
8.7232	0.5363	7.5000	9.8000	8.6228	8.8236

sps=MUC form=FDP

Analysis Variable : fflow fflow					
Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean
9.1839	0.7189	6.0000	10.6000	9.0493	9.3185

sps=PPB form=SDP

Analysis Variable : fflow fflow					
Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean	Upper 95% CL for Mean

7.9609	0.4367	7.0000	9.5000	7.8845	8.0373

AEH-11-PSEUDO-02

sps=WAS form=FDP

Analysis Variable : fflow fflow					
Mean	**Std Dev**	**Minimum**	**Maximum**	**Lower 95% CL for Mean**	**Upper 95% CL for Mean**
8.6234	0.5199	7.2000	10.0000	8.5325	8.7144

Performed by K. Weber SAS version 9.4 09:43 07MAY14 KW

Flow Rate Means by Species and Formulation

The MEANS Procedure

AEH-11-PSEUDO-02

Analysis Variable : oflow	
Minimum	Maximum
0	6.9000000

Performed by K. Weber SAS version 9.4 09:43 07MAY14 KW

FF # 18
Item No. 2
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```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
```

AEH-11-PSEUDO-02

```
options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels fr(
title2 h=2 'Statistical Analysis of Holding Chamber Flow Rates';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/************************************************************
* SAS ver 9.4       Analysis prepared by:  KLW              *
* Analysis completion date:  07MAY14                        *
************************************************************/

/***********************************************************************************************
* Variable Names:
* sps = three letter code for mussel species
*            BLS = Black sandshell (Ligumia recta)
*            FAM = Fatmucket (Lampsilis siliquoidea)
*            WAS = Washboard (Megalonaias nervosa)
*            HGE = Higgins eye (Lampsilis higginsii)
*            PPB = Plain pocketbook (Lapsilis cardium)
*            HIC = Hickorynut (Obovaria olivaria)
*            MUC = Mucket (Actinonaias ligamentina)
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
* day = sampling day
*            -2 = Pre-exposure
*            -1 = During exposure
*            0 -7 = Day 0 to Day 7 duing the holding period
* id = chamber ID (Block A or B; Chamber 1 through 12)
* fflow = measured flow (if oflow was < 7 mL/min, then fflow is the fixed measured flow)
* oflow = original flow if < 7 mL/min
***********************************************************************************************

data flow; set Pseudo02.flow;
    origfl = oflow + 0;
    drop oflow;
    rename origfl = oflow;

proc sort data=flow; by sps form day; run;
proc print data=flow; run;

/*****************************************************************************************
* This analysis calculates mean flow rates for each species during each sampling period    *
*****************************************************************************************/
title1 h=2 'Flow Rate Means by Species and Formulation';
proc means data = flow mean std min max clm fw=8;
by sps form;
class day;
var fflow;
run;
```

FF # 18
Item No. 3
Pg 1 of 2

```
/*****************************************************************************************
* This analysis calculates mean flow rates for each species over all sampling periods      *
*****************************************************************************************/
title1 h=2 'Flow Rate Means by Species and Formulation';
```

```
proc means data = flow mean std min max clm fw=8;
by sps form;
var fflow;
run;
```

AEH-11-PSEUDO-02

```
/*********************************************************************************************
* This analysis determines the range flow rates for the original flows < 7 mL/min for all   *
* species and all sampling durations                                                        *
*********************************************************************************************/
proc means data = flow min max;
var oflow;
run;
```

FF # 18
Item No. 3
Pg 2 of 2

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile
mussels from seven different unionid species';
title2 h=2 'Statistical Analysis of Holding Chamber Flow Rates';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/**********************************************************
* SAS ver 9.4       Analysis prepared by:  KLW            *
* Analysis completion date:  07MAY14                      *
**********************************************************/

/*****************************************************************************************
*************
* Variable Names:
             *
* sps = three letter code for mussel species
             *
*            BLS = Black sandshell (Ligumia recta)
             *
*            FAM = Fatmucket (Lampsilis siliquoidea)
             *
*            WAS = Washboard (Megalonaias nervosa)
             *
*            HGE = Higgins eye (Lampsilis higginsii)
             *
*            PPB = Plain pocketbook (Lapsilis cardium)
             *
*            HIC = Hickorynut (Obovaria olivaria)
             *
*            MUC = Mucket (Actinonaias ligamentina)
             *
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
             *
* day = sampling day
             *
*            -2 = Pre-exposure
             *
*            -1 = During exposure
             *
*            0 -7 = Day 0 to Day 7 duing the holding period
             *
* id = chamber ID (Block A or B; Chamber 1 through 12)
             *
* fflow = measured flow (if oflow was < 7 mL/min, then fflow is the fixed measured flow)
             *
* oflow = original flow if < 7 mL/min
             *
*****************************************************************************************
************/

data flow; set Pseudo02.flow;
```

AEH-11-PSEUDO-02

FF # 18
Item No. 4
Pg 1 of 3

```
323      origfl = oflow + 0;
324      drop oflow;
325      rename origfl = oflow;
326

NOTE: Character values have been converted to numeric values at the places given by:
      (Line):(Column).
      323:14
NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      830 at 323:20
NOTE: There were 865 observations read from the data set PSEUDO02.FLOW.
NOTE: The data set WORK.FLOW has 865 observations and 6 variables.
NOTE: DATA statement used (Total process time):
      real time           0.02 seconds
      cpu time            0.01 seconds


327  proc sort data=flow; by sps form day; run;

NOTE: There were 865 observations read from the data set WORK.FLOW.
NOTE: The data set WORK.FLOW has 865 observations and 6 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


328  proc print data=flow; run;
NOTE: Writing HTML Body file: sashtml5.htm

NOTE: There were 865 observations read from the data set WORK.FLOW.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           1.84 seconds
      cpu time            0.95 seconds


329
330  /*********************************************************************************************
330! *
331  * This analysis calculates mean flow rates for each species during each sampling period
331! *
332  *********************************************************************************************
332! /
333  title1 h=2 'Flow Rate Means by Species and Formulation';
334  proc means data = flow mean std min max clm fw=8;
335  by sps form;
336  class day;
337  var fflow;
338  run;

NOTE: There were 865 observations read from the data set WORK.FLOW.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.07 seconds
      cpu time            0.03 seconds
```

AEH-11-PSEUDO-02

```
/*********************************************************************************************
 *
 * This analysis calculates mean flow rates for each species over all sampling periods
 *
 *********************************************************************************************
 /
title1 h=2 'Flow Rate Means by Species and Formulation';
proc means data = flow mean std min max clm fw=8;
by sps form;
var fflow;
run;

NOTE: There were 865 observations read from the data set WORK.FLOW.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.04 seconds
      cpu time            0.03 seconds


/*********************************************************************************************
 *
 * This analysis determines the range flow rates for the original flows < 7 mL/min for all
 *
 * species and all sampling durations
 *
 *********************************************************************************************
 /
proc means data = flow min max;
var oflow;
run;

NOTE: There were 865 observations read from the data set WORK.FLOW.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.03 seconds
      cpu time            0.00 seconds
```

FF # 15
Item No. 4
Pg 3 of 3

Study Number: AEH-11-PSEUDO-02		Action	Date	Initials
Data Source:	File Folders: 18c	Created......	1-May-14	KLW KW
	System Condition Form 3	Revised......	19-Nov-14	KLW KW
		Reviewed...	19JUN14	KW
File Name:	I:\AEH-11-PSEUDO-02\Data\[PSEUDO-02 System Conditions for SAS.xlsx]Light Intensity	Certified...		

System Conditions - Light Intensity

Species, Dosing, and Assessment Information

Scientific Name	Common Name	Abbreviation	Formulation Type	Test Article Lot Number	Exposure Date	Assessment Date
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	12-Jul-11	20-Jul-11
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	14-Jul-11	22-Jul-11
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	13-Dec-11	21-Dec-11
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	27-Jan-12	4-Feb-12
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	17-Apr-12	25-Apr-12
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	16-May-12	24-May-12
Lampsilis higginsii	Higgins eye	HGE	SDP	TR4669-4-(5)	26-May-12	3-Jun-12

Light Intensity Data Codes used within SAS

sps = Juvenile mussel species (see 3 letter abbreviation codes above)

time = Sample time

- 0 = Pre-exposure
- 1 = First sampling time during exposure
- 2 = Second sampling time during exposure
- 3 = First sampling time during holding period
- 4 = Second sampling time during holding period

form = Product formulation

- FDP = Freeze dried powder
- SDP = Spray dried powder

id = Exposure chamber ID

- i.e., 1A2 = Test system (1, 2, or 3), Block ID (A or B), and Position in Block (1-12)

lux = Light Intensity (in lumen/m^2)

Data Explanation

System condition data analyses were limited to simple descriptive statistics (Proc Means) using SAS Version 9.4.

Data Anomalies and Deviations

NONE

File Folder 18
Item Number 5
Page 1 of 3

sps	time	form	id	lux
WAS	0	FDP	A	124
WAS	0	FDP	B	183
WAS	1	FDP	A	85
WAS	1	FDP	B	99
WAS	2	FDP	A	207
WAS	2	FDP	B	195
WAS	3	FDP	A	204
WAS	3	FDP	B	192
WAS	4	FDP	A	207
WAS	4	FDP	B	189
HIC	0	FDP	A	107
HIC	0	FDP	B	102
HIC	1	FDP	A	111
HIC	1	FDP	B	108
MUC	1	FDP	A	150
MUC	1	FDP	B	179
MUC	2	FDP	A	140
MUC	2	FDP	B	172
HIC	3	FDP	A	111
HIC	3	FDP	B	405
HIC	4	FDP	A	121
HIC	4	FDP	B	114
MUC	3	FDP	A	138
MUC	3	FDP	B	164
MUC	4	FDP	A	150
MUC	4	FDP	B	187
FAM	1	SDP	A	133
FAM	1	SDP	B	161
FAM	2	SDP	A	130
FAM	2	SDP	B	177
FAM	3	SDP	A	136
FAM	3	SDP	B	163
FAM	4	SDP	A	141
FAM	4	SDP	B	145
BLS	1	SDP	A	175
BLS	1	SDP	B	228
BLS	2	SDP	A	173
BLS	2	SDP	B	247
BLS	3	SDP	A	165
BLS	3	SDP	B	247
BLS	4	SDP	A	164
BLS	4	SDP	B	242
PPB	1	SDP	A	183
PPB	1	SDP	B	145
PPB	2	SDP	A	189
PPB	2	SDP	B	168

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PPB	3	SDP	A	228
PPB	3	SDP	B	312
PPB	4	SDP	A	159
PPB	4	SDP	B	116
HGE	1	SDP	A	165
HGE	1	SDP	B	152
HGE	2	SDP	A	183
HGE	2	SDP	B	153
HGE	3	SDP	A	144
HGE	3	SDP	B	102
HGE	4	SDP	A	166
HGE	4	SDP	B	132

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Item No. 5
Pg 3 of 3

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species
Statistical Analysis of Light Intensity
SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW

AEH-11-PSEUDO-02

Obs	sps	time	form	id	lux
1	HIC	0	FDP	A	107
2	HIC	0	FDP	B	102
3	HIC	1	FDP	A	111
4	HIC	1	FDP	B	108
5	HIC	3	FDP	A	111
6	HIC	3	FDP	B	405
7	HIC	4	FDP	A	121
8	HIC	4	FDP	B	114
9	MUC	1	FDP	A	150
10	MUC	1	FDP	B	179
11	MUC	2	FDP	A	140
12	MUC	2	FDP	B	172
13	MUC	3	FDP	A	138
14	MUC	3	FDP	B	164
15	MUC	4	FDP	A	150
16	MUC	4	FDP	B	187
17	WAS	0	FDP	A	124
18	WAS	0	FDP	B	183
19	WAS	1	FDP	A	85
20	WAS	1	FDP	B	99
21	WAS	2	FDP	A	207
22	WAS	2	FDP	B	195
23	WAS	3	FDP	A	204
24	WAS	3	FDP	B	192
25	WAS	4	FDP	A	207
26	WAS	4	FDP	B	189
27	BLS	1	SDP	A	175
28	BLS	1	SDP	B	228
29	BLS	2	SDP	A	173
30	BLS	2	SDP	B	247

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Pg 1 of 3

kw

31	BLS	3	SDP	A	165
32	BLS	3	SDP	B	247
33	BLS	4	SDP	A	164
34	BLS	4	SDP	B	242
35	FAM	1	SDP	A	133
36	FAM	1	SDP	B	161
37	FAM	2	SDP	A	130
38	FAM	2	SDP	B	177
39	FAM	3	SDP	A	136
40	FAM	3	SDP	B	163
41	FAM	4	SDP	A	141
42	FAM	4	SDP	B	145
43	HGE	1	SDP	A	165
44	HGE	1	SDP	B	152
45	HGE	2	SDP	A	183
46	HGE	2	SDP	B	153
47	HGE	3	SDP	A	144
48	HGE	3	SDP	B	102
49	HGE	4	SDP	A	166
50	HGE	4	SDP	B	132
51	PPB	1	SDP	A	183
52	PPB	1	SDP	B	145
53	PPB	2	SDP	A	189
54	PPB	2	SDP	B	168
55	PPB	3	SDP	A	228
56	PPB	3	SDP	B	312
57	PPB	4	SDP	A	159
58	PPB	4	SDP	B	116

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Performed by K. Weber SAS version 9.4 09:25 07MAY14

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Light Intensity Means by Species and Formulation

The MEANS Procedure

AEH-11-PSEUDO-02

form=FDP

Analysis Variable : lux lux							
sps	**N Obs**	**Mean**	**Std Dev**	**Minimum**	**Maximum**	**Lower 95% CL for Mean**	**Upper 95% CL for Mean**
HIC	8	147.4	104.2	102.0	405.0	60.2259	234.5
MUC	8	160.0	18.2600	138.0	187.0	144.7	175.3
WAS	10	168.5	47.0136	85.0000	207.0	134.9	202.1

form=SDP

Analysis Variable : lux lux							
sps	**N Obs**	**Mean**	**Std Dev**	**Minimum**	**Maximum**	**Lower 95% CL for Mean**	**Upper 95% CL for Mean**
BLS	8	205.1	38.9705	164.0	247.0	172.5	237.7
FAM	8	148.3	16.8417	130.0	177.0	134.2	162.3
HGE	8	149.6	24.6283	102.0	183.0	129.0	170.2
PPB	8	187.5	60.0880	116.0	312.0	137.3	237.7

Performed by K. Weber SAS version 9.4 09:25 07MAY14

FF # 18
Item No. 6
Pg 3 of 3

KW

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
```

AEH-11-PSEUDO-02

```
options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels fr(
title2 h=2 'Statistical Analysis of Light Intensity';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/************************************************************
* SAS ver 9.4       Analysis prepared by:  KLW              *
* Analysis completion date:  07MAY14     KW                 *
*************************************************************/

/*****************************************************************************************************
* Variable Names:
* sps = three letter code for mussel species
*           BLS = Black sandshell (Ligumia recta)
*           FAM = Fatmucket (Lampsilis siliquoidea)
*           WAS = Washboard (Megalonaias nervosa)
*           HGE = Higgins eye (Lampsilis higginsii)
*           PPB = Plain pocketbook (Lapsilis cardium)
*           HIC = Hickorynut (Obovaria olivaria)
*           MUC = Mucket (Actinonaias ligamentina)
* time = light intensity sampling time
*           0 = Pre-exposure
*           1 = Time 1 during exposure
*           2 = Time 2 during exposure
*           3 = Time 1 during the holding period
*           4 = Time 2 during the holding period
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
* id = block ID where light was measured (A or B)
* lux = lumen/m2
*****************************************************************************************************

data light; set Pseudo02.light;

proc sort data=light; by form sps time id; run;
proc print data=light; run;

title1 h=2 'Light Intensity Means by Species and Formulation';
proc means data = light mean std min max clm fw=8;
by form;
class sps;
var lux;
run;
```

FF # 18
Item No. 7
Pg 1 of 1

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber SAS version' &SYSVER &SYSTIME &SYSDATE;
WARNING: The FOOTNOTE statement is ambiguous due to invalid options or unquoted text.

options ls=97 ps=57 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=2 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile
! mussels from seven different unionid species';
title2 h=2 'Statistical Analysis of Light Intensity';
title3 h=2 'SAS v. 9.4 Analysis Completion Date: 07MAY2014 Analysis prepared by: KLW';
/**************************************************************
* SAS ver 9.4       Analysis prepared by:  KLW                *
* Analysis completion date:   07MAY14       KW                 *
**************************************************************/

/*********************************************************************************************
! *************
* Variable Names:
!              *
* sps = three letter code for mussel species
!              *
*              BLS = Black sandshell (Ligumia recta)
!              *
*              FAM = Fatmucket (Lampsilis siliquoidea)
!              *
*              WAS = Washboard (Megalonaias nervosa)
!              *
*              HGE = Higgins eye (Lampsilis higginsii)
!              *
*              PPB = Plain pocketbook (Lapsilis cardium)
!              *
*              HIC = Hickorynut (Obovaria olivaria)
!              *
*              MUC = Mucket (Actinonaias ligamentina)
!              *
* time = light intensity sampling time
!              *
*              0 = Pre-exposure
!              *
*              1 = Time 1 during exposure
!              *
*              2 = Time 2 during exposure
!              *
*              3 = Time 1 during the holding period
!              *
*              4 = Time 2 during the holding period
!              *
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
!              *
* id = block ID where light was measured (A or B)
!              *
* lux = lumen/m2
!              *
*********************************************************************************************
! ************/
```

FF # 18
Item No. 8
Pg 1 of 2

```
data light; set Pseudo02.light;

NOTE: There were 58 observations read from the data set PSEUDO02.LIGHT.
NOTE: The data set WORK.LIGHT has 58 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.00 seconds


proc sort data=light; by form sps time id; run;

NOTE: There were 58 observations read from the data set WORK.LIGHT.
NOTE: The data set WORK.LIGHT has 58 observations and 5 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.00 seconds


proc print data=light; run;
NOTE: Writing HTML Body file: sashtml.htm

NOTE: There were 58 observations read from the data set WORK.LIGHT.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           1.61 seconds
      cpu time            0.45 seconds



title1 h=2 'Light Intensity Means by Species and Formulation';
proc means data = light mean std min max clm fw=8;
by form;
class sps;
var lux;
run;

NOTE: There were 58 observations read from the data set WORK.LIGHT.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.04 seconds
      cpu time            0.01 seconds
```

AEH-11-PSEUDO-02

KW 7MAR2014

FF # 18
Item No. 8
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Proofed: SMS 9DEC2011
KLW 01 DEC 2011

AEH-11-PSEUDO-02

Water Quality Laboratory
Upper Midwest Environmental Science Center
USGS

2630 Fanta Reed Road
La Crosse, Wi 54603

Analyzing Date: 07/18 -07/19/2011
Report Date: 08/23/2011

Sample Description:
3 mL acidified exposure water(0.45 µm filtrated)
Study #: AEH-PSEUDO-02

Upper Midwest Environmental Science Center
Attn: James Luoma
2630 Fanta Reed Road
La Crosse, Wi54603

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_3-N/L)
T0HIC100	0.045
T0HIC200	0.069
T0HIC300	0.104
T0HIC300HD	0.096
T0HIC50	0.033
T0HICCONTROL	0.022
T0MUC100	0.033
T0MUC200	0.057
T0MUC300	0.083
T0MUC300HD	0.080
T0MUC50	0.022
T0MUCCONTROL	0.011
T121A1	0.508
T121A10	0.068
T121A11	0.151
T121A12	0.466
T121A2	0.017
T121A3	0.324
T121A4	0.206
T121A5	0.012
T121A6	0.068
T121A7	0.131
T121A8	0.117
T121A9	0.129

FF # 10h
Item No. 1
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REPORT OF ANALYSIS

AEH-11-PSEUDO-02

Sample Code	Results (total ammonia nitrogen, mg NH_3-N/L)
T121B1	0.325
T121B10	0.071
T121B11	0.076
T121B12	0.033
T121B2	0.022
T121B3	0.022
T121B4	0.353
T121B5	0.066
T121B6	0.064
T121B7	0.064
T121B8	0.008
T121B9	0.079
T122A1	0.435
T122A10	0.162
T122A11	0.051
T122A12	0.209
T122A2	0.531
T122A3	0.150
T122A4	0.017
T122A5	0.285
T122A6	1.567
T122A7	0.141
T122A8	0.152
T122A9	0.375
T122B1	0.124
T122B10	0.022
T122B11	0.370
T122B12	0.342
T122B2	0.600
T122B3	0.162
T122B4	0.473
T122B5	0.124
T122B6	0.128
T122B7	0.019
T122B8	0.264
T122B9	0.132
T241A1	8.313
T241A10	11.63
T241A11	8.181
T241A12	11.50
T241A2	0.017

REPORT OF ANALYSIS

AEH-11-PSEUDO-02

Not Legible [illegible]

AEH-11-PSEUDO-02

Sample Code	Results (total ammonia nitrogen, mg NH_3-N/L)
T241A3	11.244
T241A4	1.210
T241A5	0.012
T241A6	3.657
T241A7	1.174
T241A8	11.78
T241A9	3.714
T241B1	9.028
T241B10	3.130
T241B11	1.352
T241B12	0.010
T241B2	0.022
T241B3	3.511
T241B4	10.235
T241B5	6.744
T241B6	11.906
T241B7	11.304
T241B8	7.968
T241B9	1.302
T242A1	8.800
T242A10	1.266
T242A11	0.013
T242A12	11.237
T242A2	12.373
T242A3	1.495
T242A4	0.012
T242A5	10.165
T242A6	4.212
T242A7	4.133
T242A8	10.208
T242A9	9.696
T242B1	10.533
T242B10	0.011
T242B11	7.168
T242B12	7.083
T242B2	12.13
T242B3	2.477
T242B4	11.61
T242B5	1.271
T242B6	10.703
T242B7	0.012

REPORT OF ANALYSIS

Sample Code	Results (total ammonia nitrogen, mg NH_3-N/L)
T242B8	3.999
T242B9	1.395
T61A1	0.109
T61A10	0.094
T61A11	0.084
T61A12	0.154
T61A2	0.013
T61A3	0.140
T61A4	0.063
T61A5	0.015
T61A6	0.054
T61A7	0.031
T61A8	0.088
T61A9	0.062
T61B1	0.139
T61B10	0.054
T61B11	0.034
T61B12	0.021
T61B2	0.016
T61B3	0.036
T61B4	0.305
T61B5	0.093
T61B6	0.082
T61B7	0.083
T61B8	0.098
T61B9	0.039
T62A1	0.106
T62A10	0.058
T62A11	0.021
T62A12	0.100
T62A2	0.151
T62A3	0.042
T62A4	0.018
T62A5	0.110
T62A6	0.225
T62A7	0.061
T62A8	0.105
T62A9	0.187
T62B1	0.087
T62B10	0.018
T62B11	0.109

AEH-11-PSEUDO-02

REPORT OF ANALYSIS

Sample Code		Results (total ammonia nitrogen, mg NH_3-N/L)
T62B12		0.103
T62B2		0.138
T62B3		0.075
T62B4		0.150
T62B5	AEH-11-PSEUDO-02	0.080
T62B6		0.093
T62B7		0.017
T62B8		0.061
T62B9		0.043

Water quality laboratory
UMESC

[redacted]
Shirley Yuan, Laboratory Director

FF # 10h
Item No. 1
Pg 5 of 5

Water Quality Laboratory
Upper Midwest Environmental Sciences Center
USGS
2630 Fanta Reed Road
La Crosse, WI 54603

Sample Description: 3 mL acidified exposure water (0.45 µm filtrated)
Study #: AEH-PSEUDO 02

Upper Midwest Environmental Sciences Center
attn: James Luoma
2630 Fanta Reed Road
La Crosse, WI54603

Analyzing Date: 12/28 /2011, 01/06/2012
Report Date: 01/09/2012

AEH-11-PSEUDO-02

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_3-N/L)
2A10T12H	1.704
2A10T24H	5.119
2A10T6H	0.232
2A11T12H	0.371
2A11T24H	0.334
2A11T6H	0.07
2A12T12H	0.234
2A12T24H	0.98
2A12T6H	0.151
2A1T12H	0.32
2A1T24H	0.393
2A1T6H	0.127
2A2T12H	0.563
2A2T24H	2.641
2A2T6H	0.293
2A3T12H	0.43
2A3T24H	2.308
2A3T6H	0.127
2A4T12H	1.389
2A4T24H	8.46
2A4T6H	0.302
2A5T12H	1.547
2A5T24H	7.593
2A5T6H	0.264
2A6T12H	0.576
2A6T24H	4.288
2A6T6H	0.329
2A7T12H	1.325
2A7T24H	9.719
2A7T6H	0.251
2A8T12H	1.848
2A8T24H	7.269
2A8T6H	0.374
2A9T12H	0.079
2A9T24H	0.057
2A9T6H	0.065
2B10T12H	1.527
2B10T24H	5.424
2B10T6H	0.286
2B11T12H	0.389
2B11T24H	1.67
2B11T6H	0.171
2B12T12H	1.2
2B12T24H	2.744
2B12T6H	0.255
2B1T12H	0.076
2B1T24H	0.053
2B1T6H	0.08
2B2T12H	0.444
2B2T24H	1.631
2B2T6H	0.194
2B3T12H	0.979
2B3T24H	6.741
2B3T6H	0.263
2B4T12H	1.169
2B4T24H	5.593
2B4T6H	0.359
2B5T12H	1.073
2B5T24H	5.435
2B5T6H	0.247
2B6T24H	5.928
2B6T6H	0.338
2B6T12H	1.207
2B7T12H	0.095
2B7T24H	0.015
2B7T6H	0.082
2B7TWEEKLY	0.025
2B8T12H	1.391
2B8T24H	5.527
2B8T6H	0.232
2B9T12H	0.403
2B9T24H	2.535
2B9T6H	0.188
2T1440	0.089

USGS
Water Quality Laboratory
Laboratory Director [redacted]
Xia[redacted]Yuan

FF # 10h
Item No. 2
Pg 1 of 1

Water Quality Laboratory
Upper Midwest Environmental Sciences Center
USGS
2630 Fanta Reed Road
La Crosse, WI 54603

Sample Description: 3 mL acidified exposure water (0.45 µm filtrated)
Study #: AEH-11-PSEUDO-02

Upper Midwest Environmental Sciences Center
attn: James Luoma
2630 Fanta Reed Road
La Crosse, WI54603

Analyzing Date: 02/07/2012
Report Date: 02/21/2012

AEH-11-PSEUDO-02

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_3-N/L)
FAM1A10T12H	0.672
FAM1A10T24H	4.034
FAM1A10T6H	0.719
FAM1A11T12H	0.066
FAM1A11T24H	1.618
FAM1A11T6H	0.403
FAM1A12T12H	0.419
FAM1A12T24H	3.36
FAM1A12T6H	0.619
FAM1A1T12H	0.068
FAM1A1T24H	0.063
FAM1A1T6H	0.137
FAM1A2T12H	0.052
FAM1A2T24H	1.352
FAM1A2T6H	0.242
FAM1A3T12H	0.064
FAM1A3T24H	0.75
FAM1A3T6H	0.186
FAM1A4T12H	0.735
FAM1A4T24H	3.348
FAM1A4T6H	0.753
FAM1A5T12H	0.406
FAM1A5T24H	3.17
FAM1A5T6H	0.582
FAM1A6T12H	0.661
FAM1A6T24H	3.664
FAM1A6T6H	0.698
FAM1A7T12H	0.049
FAM1A7T24H	0.05
FAM1A7T6H	0.082
FAM1A8T12H	0.677
FAM1A8T24H	5.135
FAM1A8T6H	0.665
FAM1A9T12H	0.135
FAM1A9T24H	0.504
FAM1A9T6H	0.203
FAM1B10T12H	0.089
FAM1B10T24H	0.103
FAM1B10T6H	0.077
FAM1B11T12H	0.165
FAM1B11T24H	1.4
FAM1B11T6H	0.252
FAM1B12T12H	0.88
FAM1B12T24H	5.037
FAM1B12T6H	0.751
FAM1B1T12H	0.098
FAM1B1T24H	0.749
FAM1B1T6H	0.162
FAM1B2T12H	0.813
FAM1B2T24H	3.759
FAM1B2T6H	0.698
FAM1B3T12H	0.059
FAM1B3T24H	1.509
FAM1B3T6H	0.242
FAM1B4T12H	0.828
FAM1B4T24H	4.51
FAM1B4T6H	0.774
FAM1B5T12H	0.06
FAM1B5T24H	0.088
FAM1B5T6H	0.084
FAM1B6T12H	0.058
FAM1B6T24H	0.866
FAM1B6T6H	0.149
FAM1B7T12H	0.217
FAM1B7T24H	2.569
FAM1B7T6H	0.566
FAM1B8T12H	1.025
FAM1B8T24H	4.041
FAM1B8T6H	0.798
FAM1B8WEEKLY	0.094
FAM1B9T12H	0.567
FAM1B9T24H	3.52
FAM1B9T6H	0.569
FAMHEADBOXPRE	0.182

USGS
Water Quality Laboratory
Laboratory Director: [redacted]
Xiaoli Yuan [redacted]

FF # 16h
Item No. 3
Pg 1 of 1

Sample Description: 3 mL acidified exposure water (0.45 µm filtrated)
Study #: AEH-11-PSEUDO-02

Upper Midwest Environmental Sciences Center
attn: James Luoma
2630 Fanta Reed Road
La Crosse, WI54603

Water Quality Laboratory
Upper Midwest Environmental Sciences Center
USGS
2630 Fanta Reed Road
La Crosse, WI 54603

Analyzing Date: 04/23/2012
Report Date: 04/24/2012

AEH-11-PSEUDO-02

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_4-N/L)
BLS2A10T12H	0.103
BLS2A10T24H	4.078
BLS2A10T6H	0.155
BLS2A11T12H	0.139
BLS2A11T24H	4.967
BLS2A11T6H	0.159
BLS2A12T12H	0.057
BLS2A12T24H	0.201
BLS2A12T6H	0.062
BLS2A1T12H	0.08
BLS2A1T24H	4.918
BLS2A1T6H	0.138
BLS2A2T12H	0.082
BLS2A2T24H	5.159
BLS2A2T6H	0.167
BLS2A3T12H	0.042
BLS2A3T24H	1.292
BLS2A3T6H	0.091
BLS2A4T12H	0.044
BLS2A4T24H	3.782
BLS2A4T6H	0.115
BLS2A5T12H	0.038
BLS2A5T24H	1.969
BLS2A5T6H	0.083
BLS2A6T12H	0.046
BLS2A6T24H	0.064
BLS2A6T6H	0.035
BLS2A7T12H	0.076
BLS2A7T24H	5.01
BLS2A7T6H	0.159
BLS2A8T12H	0.054
BLS2A8T24H	0.084
BLS2A8T6H	0.045
BLS2A9T12H	0.04
BLS2A9T24H	0.175
BLS2A9T6H	0.058
BLS2B10T12H	0.068
BLS2B10T24H	4.911
BLS2B10T6H	0.154
BLS2B11T12H	0.049
BLS2B11T24H	0.058
BLS2B11T6H	0.041
BLS2B12T12H	0.059
BLS2B12T24H	0.458
BLS2B12T6H	0.107
BLS2B1T12H	0.119
BLS2B1T24H	4.234
BLS2B1T6H	0.161
BLS2B2T12H	0.056
BLS2B2T24H	3.928
BLS2B2T6H	0.1
BLS2B3T12H	0.074
BLS2B3T24H	4.871
BLS2B3T6H	0.164
BLS2B4T12H	0.114
BLS2B4T24H	3.778
BLS2B4T6H	0.164
BLS2B5T12H	0.035
BLS2B5T24H	0.178
BLS2B5T6H	0.054
BLS2B6T12H	0.062
BLS2B6T24H	3.381
BLS2B6T6H	0.134
BLS2B7T12H	0.043
BLS2B7T24H	1.453
BLS2B7T6H	0.076
BLS2B8T12H	0.35
BLS2B8T24H	0.217
BLS2B8T6H	0.057
BLS2B9T12H	0.042
BLS2B9T24H	0.06
BLS2B9T6H	0.047
BLSPREEXPOSURE	0.078

USGS
Water Quality Laboratory
Laboratory Director [redacted]
Xiaoli Yuan

FF # 10h
Item No. 4
Pg 1 of 1

Sample Description: 3 mL acidified exposure water (0.45 μm filtrated)
Study #: AEH-11-PSEUDO-02

Upper Midwest Environmental Sciences Center
attn: James Luoma
2630 Fanta Reed Road
La Crosse, WI54603

Water Quality Laboratory
Upper Midwest Environmental Sciences Center
USGS
2630 Fanta Reed Road
La Crosse, WI 54603

Analyzing Date:05/01/2012
Report Date: 05/08/2014

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_3-N/L)
BLS2B3TWEEKLY	0.053

AEH-11-PSEUDO-02

USGS
Water Quality Laboratory
Laboratory Director
[redacted]
Xiaoli Yuan

FF # 10h
Item No. 5
Pg 1 of 1

Sample Description: 3 mL acidified exposure water (0.45 µm filtrated)
Study #: AEH-12-PSEUDO-03
Study #: AEH-11-PSEUDO-02
Upper Midwest Environmental Sciences Center
attn: James Luoma
2630 Fanta Reed Road
La Crosse, WI54603

Water Quality Laboratory
Upper Midwest Environmental Sciences Center
USGS
2630 Fanta Reed Road
La Crosse, WI 54603

Analyzing Date: 05/21/2012
Report Date: 05/24/2012

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_3-N/L)
BKT-100-A-24H	0.153
BKT-100-B-24H	0.159
BKT-100-C-24H	0.147
BKT-200-A-24H	0.18
BKT-200-B-24H	0.181
BKT-200-C-24H	0.184
BKT-300-A-24H	0.207
BKT-300-B-24H	0.216
BKT-300-C-24H	0.207
BKT-50-A-24H	0.143
BKT-50-B-24H	0.135
BKT-50-C-24H	0.133
BKT-CONTROL-A-24H	0.132
BKT-CONTROL-B-24H	0.121
BKT-CONTROL-C-24H	0.122
PPB1A10T12H	0.096
PPB1A10T24H	0.188
PPB1A10T6H	0.089
PPB1A11T12H	0.111
PPB1A11T24H	0.438
PPB1A11T6H	0.159
PPB1A12T12H	0.12
PPB1A12T24H	0.493
PPB1A12T6H	0.147
PPB1A1T12H	0.104
PPB1A1T24H	0.089
PPB1A1T6H	0.086
PPB1A2T12H	0.123
PPB1A2T24H	2.118
PPB1A2T6H	0.153
PPB1A3T12H	0.117
PPB1A3T24H	0.118
PPB1A3T6H	0.093
PPB1A4T12H	0.159
PPB1A4T24H	0.498
PPB1A4T6H	0.173
PPB1A5T12H	0.102
PPB1A5T24H	0.418
PPB1A5T6H	0.16
PPB1A6T12H	0.122
PPB1A6T24H	0.412
PPB1A6T6H	0.134
PPB1A7T12H	0.102
PPB1A7T24H	0.492
PPB1A7T6H	0.133
PPB1A8T12H	0.092
PPB1A8T24H	0.233
PPB1A8T6H	0.115
PPB1A9T12H	0.111
PPB1A9T24H	0.514
PPB1A9T6H	0.2
PPB1B10T12H	0.093
PPB1B10T24H	0.068
PPB1B10T6H	0.097
PPB1B11T12H	0.093
PPB1B11T6H	0.176
PPB1B12T12H	0.085
PPB1B12T24H	1.305
PPB1B12T6H	0.104
PPB1B1T12H	0.087
PPB1B1T24H	0.411
PPB1B1T6H	0.116
PPB1B2T12H	0.107
PPB1B2T24H	2.016
PPB1B2T6H	0.197
PPB1B3T12H	0.09
PPB1B3T24H	0.329
PPB1B3T6H	0.088
PPB1B4T12H	0.115
PPB1B4T24H	2.114
PPB1B4T6H	0.161
PPB1B5T12H	0.087
PPB1B5T24H	0.572
PPB1B5T6H	0.107
PPB1B6T12H	0.104
PPB1B6T24H	2.059
PPB1B6T6H	0.145
PPB1B7T12H	0.098
PPB1B7T24H	1.176
PPB1B7T6H	0.116
PPB1B8T12H	0.09
PPB1B8T24H	0.401
PPB1B8T6H	0.101
PPB1B9T12H	0.105
PPB1B9T24H	0.054
PPB1B9T6H	0.107
PPB1BHT24H	2.194
PPBPRE-EXPT1510	0.108

USGS
Water Quality Laboratory
Laboratory Director
[redacted]

AEH-11-PSEUDO-02

FF # 10h
Item No. 6
Pg 1 of 1

Sample Description: 3 mL acidified exposure water (0.45 µm filtrated)
Study #: AEH-11-PSEUDO-02

Upper Midwest Environmental Sciences Center
attn: James Luoma
2630 Fanta Reed Road
La Crosse, WI54603

Water Quality Laboratory
Upper Midwest Environmental Sciences Center
USGS
2630 Fanta Reed Road
La Crosse, WI 54603

Analyzing Date: 06/14/2012
Report Date: 06/15/2012

REPORT OF ANALYSIS

Sample Code	Results (Total Ammonia Nitrogen, mg NH_3-N/L)
HGE1A10T12H	0.065
HGE1A10T24H	0.290
HGE1A10T6H	0.068
HGE1A11T12H	0.159
HGE1A11T24H	2.247
HGE1A11T6H	0.167
HGE1A12T12H	0.158
HGE1A12T24H	3.462
HGE1A12T6H	0.188
HGE1A1T12H	0.031
HGE1A1T24H	0.056
HGE1A1T6H	0.019
HGE1A2T12H	0.282
HGE1A2T24H	2.739
HGE1A2T6H	0.226
HGE1A3T12H	0.065
HGE1A3T24H	1.590
HGE1A3T6H	0.111
HGE1A4T12H	0.086
HGE1A4T24H	1.882
HGE1A4T6H	0.154
HGE1A5T12H	0.347
HGE1A5T24H	3.955
HGE1A5T6H	0.235
HGE1A6T12H	0.050
HGE1A6T24H	0.272
HGE1A6T6H	0.073
HGE1A7T12H	0.186
HGE1A7T24H	2.901
HGE1A7T6H	0.205
HGE1A8T12H	0.017
HGE1A8T24H	0.062
HGE1A8T6H	0.028
HGE1A9T12H	0.066
HGE1A9T24H	0.411
HGE1A9T6H	0.056
HGE1B10T12H	0.027
HGE1B10T24H	0.203
HGE1B10T6H	0.170
HGE1B11T12H	0.087
HGE1B11T24H	3.631
HGE1B11T6H	0.175
HGE1B12T12H	0.439
HGE1B12T24H	2.283
HGE1B12T6H	0.255
HGE1B1T12H	0.013
HGE1B1T24H	0.056
HGE1B1T6H	0.022
HGE1B2T12H	0.129
HGE1B2T24H	1.826
HGE1B2T6H	0.151
HGE1B3T12H	0.161
HGE1B3T24H	1.449
HGE1B3T6H	0.096
HGE1B4T12H	0.099
HGE1B4T24H	0.064
HGE1B4T6H	0.032
HGE1B5T12H	0.389
HGE1B5T24H	2.925
HGE1B5T6H	0.170
HGE1B6T12H	0.178
HGE1B6T24H	1.516
HGE1B6T6H	0.189
HGE1B7T12H	0.492
HGE1B7T24H	3.613
HGE1B7T6H	0.216
HGE1B8T12H	0.024
HGE1B8T24H	0.058
HGE1B8T6H	0.032
HGE1B9T12H	0.207
HGE1B9T24H	1.418
HGE1B9T6H	0.039
HGEWEEKLY	0.057
PP0WEEKLY1B9T1315	0.052
PRE-EXPOSUREHGET0	0.056

AEH-11-PSEUDO-02

USGS
Water Quality Laboratory
Laboratory Director
[redacted]
Xiaoli Yuan

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Appendix 7. Animal Feed Information

Item number	Item description	Number of pages	Report page number
1	Chlorella Algae: FedEx Standard Overnight Label (shipped from Monte McGregor) – dated May 31, 2011	1	541
2	Chlorella Algae: FedEx Standard Overnight Label (shipped from Monte McGregor) – dated July 11, 2011	1	542
3	Chlorella Algae: FedEx Priority Overnight Label (shipped from Monte McGregor) – dated May 7, 2011	1	543
4	Nanno–3600 and Shelfish Diet 1800 Algae – Order Invoice from Reed Mariculture – dated May 11, 2011	1	544
5	Tet 3600 and Nanno–3600 Algae – Order Invoice from Reed Mariculture – dated March 20, 2012	1	545
6	Note from Monte McGregor regarding chlorella algae shipment – Harvest date May 10, 2011	1	546
7	Note from Monte McGregor regarding chlorella algae shipment – Harvest date June 24	1	547
8	Reed Mariculture literature on Shellfish Diet, Nannochloropsis, and Tetraselmis – Internet printout	6	548
9	Algae Stock Dry Weight Determination Procedure	1	554
10	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date May 26, 2011	3	555
11	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date June 5, 2011	1	558
12	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date June 25, 2011	1	559
13	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date July 7, 2011	1	560
14	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date December 8, 2011	3	561
15	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date January 26, 2012	1	564
16	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date March 31, 2012	2	565
17	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date April 13, 2012	1	567
18	Algae Stock Dry Weight Determination Datasheet – 48 hour dry weight date May 12, 2012	1	568
19	Algae Stock Preparation Chart – Effective date June 3, 2011	2	569
20	Algae Stock Preparation Chart – Effective date June 6, 2011	2	571
21	Algae Stock Preparation Chart – Effective date June 17, 2011	2	573
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23	Algae Stock Preparation Chart – Effective date July 7, 2011	2	577
24	Algae Stock Preparation Chart – Effective date December 8, 2011	2	579
25	Algae Stock Preparation Chart – Effective date January 25, 2012	2	581

11 [redacted]

nte McGregor Phone 502 573-0330, 221

Dept of Fish & Wildlife Resources

761 Georgetown Rd

nkfort State KY ZIP 40342 Dept/Floor/Suite/Room

illing Reference

James Luoma Phone 608 781-6391

er Midwest Environmental Sciences Center

30 Fanta Reed Rd

boxes or P.O. ZIP codes. Dept/Floor/Suite/Room

location address or for continuation of your shipping address.

Crosse State WI ZIP 54603

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FedEx location address REQUIRED. NOT available for FedEx First Overnight.

HOLD Saturday
FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

8756 3987 1869

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NOTE: Service order has changed. Please select carefully. FedEx Express Freight US Airbill.

Next Business Day

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- [x] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

- [ ] NEW FedEx 2Day A.M. — Second business morning.* Saturday Delivery NOT available.
- [ ] FedEx 2Day — Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

5 Packaging *Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak*
- [ ] FedEx Box
- [ ] FedEx Tube
- [x] Other

6 Special Handling and Delivery Signature Options

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Does this shipment contain dangerous goods?
One box must be checked.

- [x] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

- [ ] Cargo Aircraft Only

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Enter FedEx Acct. No. or Credit Card No. below.

- [ ] Sender — Acct. No. in Section 1 will be billed.
- [x] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check
- [ ] Obtain recip. Acct. No.

[redacted] 01-0 [redacted]

Total Packages ____ Total Weight ____ lbs. Total Declared Value† $ ____ .00 Credit Card Auth. NB0035 26600

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

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11-11 [redacted]

Mark McGregor Phone 502 ... 233 ...

... Dept Of ... Waste & Resources

... Coppertown ...

Frankfort State KY ZIP 40601

Dept/Floor/Suite/Room

al Billing Reference

James Luoma Phone 608 783-6451

... M. ... Environmental ... Center

2630 Fanta Reed Road

to P.O. boxes or P.O. ZIP codes. Dept/Floor/Suite/Room

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HOLD location address or for continuation of your shipping address.

La Crosse State WI ZIP 54603

8756 3987 1891

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4 Express Package Service *To most locations. **Packages up to 150 lbs.**
NOTE: Service order has changed. Please select carefully. AEH-11-PSEUDO- For packages over 150 lbs., use the new FedEx Express Freight US Airbill.

Next Business Day

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- [ ] FedEx Priority Overnight — Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [x] FedEx Standard Overnight — Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

- [ ] NEW FedEx 2Day A.M. — Second business morning.* Saturday Delivery NOT available.
- [ ] FedEx 2Day — Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver — Third business day.* Saturday Delivery NOT available.

5 Packaging *Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak*
- [ ] FedEx Box
- [ ] FedEx Tube
- [x] Other

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery — NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.
- [x] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Someone at recipient's address may sign for delivery. Fee applies.
- [ ] Indirect Signature — If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. Fee applies.

Does this shipment contain dangerous goods?
One box must be checked.

- [x] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

- [ ] Cargo Aircraft Only

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Enter FedEx Acct. No. or Credit Card No. below.

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- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check
- [ ] Obtain recip. Acct. No.

[redacted]

Total Packages	Total Weight	Total Declared Value†	Credit Card Auth.
1	1 lbs.	$ .00	

†Our liability is limited to $100 unless you declare a higher value. See the current FedEx Service Guide for details.

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[redacted]

[illegible] Phone [illegible]

[illegible]

[illegible]

Dept./Floor/Suite/Room

[illegible] State KY ZIP [illegible]

l Billing Reference

[illegible] Phone [illegible]

[illegible]

630 [illegible]

o P.O. boxes or P.O. ZIP codes. Dept./Floor/Suite/Room

HOLD location address or for continuation of your shipping address.

[illegible] State WI ZIP [illegible]

HOLD Weekday
FedEx location address REQUIRED. NOT available for FedEx First Overnight.

HOLD Saturday
FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

8756 3987 1940

FF # 13
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Next Business Day

- [ ] FedEx First Overnight
  Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [x] FedEx Priority Overnight
  Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Standard Overnight
  Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

- [ ] NEW FedEx 2Day A.M.
  Second business morning.* Saturday Delivery NOT available.
- [ ] FedEx 2Day
  Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- [ ] FedEx Express Saver
  Third business day.* Saturday Delivery NOT available.

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak*
- [ ] FedEx Box
- [ ] FedEx Tube
- [x] Other

6 Special Handling and Delivery Signature Options

- [ ] SATURDAY Delivery
  NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.
- [x] No Signature Required
  Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature
  Someone at recipient's address may sign for delivery. Fee applies.
- [ ] Indirect Signature
  If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. Fee applies.

Does this shipment contain dangerous goods?

One box must be checked.

- [x] No
- [ ] Yes As per attached Shipper's Declaration.
- [ ] Yes Shipper's Declaration not required.
- [ ] Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg
- [ ] Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

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- [x] Recipient
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- [ ] Credit Card
- [ ] Cash/Check

Obtain recip. Acct. No. [ ]

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Total Packages	Total Weight	Total Declared Value†	Credit Card Auth.
1	1 lbs.	$ .00	

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AEH-11-PSEUDO-02

Invoice

Reed Mariculture
6600 Silacci Way
Gilroy, CA 95020-7019
Phone: 408-848-8294 Billing
Toll Free: 877-732-3276 Orders
FAX: 408-377-3498
orders@reed-store.com

Order Transaction and Shipping History

Order Number	Order Status	InternetID	Order Date
22243	Shipped on 05/11/2011	201105111508RMI21112	05/11/2011

Internal Billing reference GR11NB00E526600

Billing Information	Shipping Information
James Luoma	James Luoma
Umesc	Umesc
2630 Fanta Reed Rd	2630 Fanta Reed Rd
Lacrosse , WI 54603	Lacrosse , WI 54603
United States	United States
(608) 783-6451	(608) 783-6451
jluoma@usgs.gov	jluoma@usgs.gov

Order Details

Invoice Part	Part Number	Item Description	Qty Ordered	Qty Shipped	Price	Extended
A	NAN-QT	Nanno-3600, 1 Quart Bottle	2	2	$70.00	$140.00
A	SD-QT	Shellfish Diet 1800 - 1 Quart	1	1	$44.00	$44.00
A	TET-LITER	Tet 3600 - 1 liter bag	2	2	$77.00	$154.00
Paymethod:					Subtotal	$338.00
Credit Card: 5568-XXXX-XXXX-XXXX					Shipping	$0.00
					Tax	$0.00
					Order Total	$338.00
					Amount Paid	$338.00
					Amount Due	$0.00

Transaction Journal

Invoice Part	Date	Type	Amount	Note
A	05/11/2011	Payment via MC	$338.00	CR.INCARD: 086440
A	05/11/2011	Invoice	$338.00	CHARGES FOR INVOICE: A

Shipping Details

Invoice	Status	Description	Shipdate	Tracking Number	Code
22243A	S	MID WEST PRIORITY OVERNIGHT	05/11/2011		

Date received
5/12/11 JMS

FF # 13
Item No. 4
Pg 1 of 1

Page	Date	Invoice No.
1	03/20/12	126860A

BILL TO

Todd Severson
Usgs - Umesc
2630 Fanta Reed Road
La Crosse, WI 54603

SHIP TO

AE-11-11-PSE400-03 wrong study number "02" kw 23APR12

Customer No.	Sales I.D.	Reference #	Media Code	Terms
13325	OL /OLS		I /OLS	*PACKING SLIP ONLY*

Ordered By	Warehouse	Phone Number	Total Wt.	Zone	# Packages	Ship Via
	038186	(608) 781-6216	4.6 Lbs	0	1	R08

Message:

877-732-3276

Qty.	B/O	Shipped	Item #	Description	Unit Price	Disc.	Extension
1	0	1	TET-LITER	Tet 3600 - 1 liter bag Instant Algae Tetraselmis 3600			
1	0	1	NAN-QT	Nanno-3600, 1 Quart Bottle Instant Algae Nannochloropsis			

Rec'd 3/22/12 Jr

PACKED COURTESY OF HECTOR

FF # 13
Item No. 5
Pg 1 of 1

PKG ID #126860A__

Todd Severson
Usgs - Umesc
2630 Fanta Reed Road
La Crosse, WI 54603

Ship to ____________________

MOM-11-DB

AEH-11-PSEUDO-02

Chlorella sorokiniana

~200g wet weight

~10-15% would = dry wt.

FF # 13
Item No. 6
Pg 1 of 1 [redacted]

Cultured @ Center for Mollusk Conservation from May 5-10, harvested May 10; concentrated & shipped in the afternoon

liquid culture
C. sorokiniana
harvested 6-24
kept in frzg. (~100g)

1g/10ml

[redacted]

FF # 13
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Pg 1 of 1

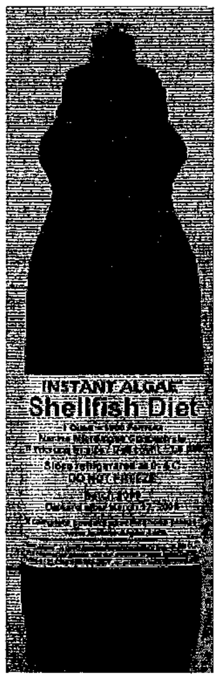
AEH-11-PSEUDO-02

AEH-11-PSEUDO-02

Shellfish Diet

AEH-11-PSEUDO-02

www.Shellfish-Diet.com



ADD TO CART

Shellfish Diet 1800® is a mix of four marine microalgae that all have demonstrated success with a variety of shellfish including oysters, clams, mussels, and scallops. A mixed diet provides a much better nutritional profile for all types of shellfish, increasing both growth rates and survival.

Shellfish Diet can be used with pre-set larvae all the way up through broodstock and will typically perform as well as live algae so it can be used as a **complete live algae replacement**. 1 quart of Shellfish Diet will replace the equivalent to 1800 liters of dense algae culture. This product is available in 1 plastic bottles of 1 quart (standard) and 1 gallon sizes (special orders).

For information on how much algae to feed shellfish CLICK HERE.

The dry weight of Shellfish Diet is always 9%. The cell count varies depending on the time of the year but is roughly **2 billion cells** per ml.

Isochrysis	30%
Pavlova	20%
Tetraselmis	20%
Thalassiosira weissflogii (TW)	30%

FF # 13
Item No. 8
Pg 1 of 6

Other Applications: Shellfish Diet 1800® is also an excellent feed for ascidians/tunicates, sea urchins, soft corals, brine shrimp, and copepods.

Shellfish Diet 1800 is part of the **Instant Algae®** product line and does not contain any preservative chemicals or filler material - just pure marine microalgae.

Contact Us
871 East Hamilton Ave, Suite #D,
Campbell, CA 95008
Phone 408-377-1065 / Fax 408-377-3498
Office hours - 9 AM to 4 PM (California PST)

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Reed-Mariculture.com

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AEH-11-PSEUDO-02

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Home

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Roti-Grow & N-Rich Products
****
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Rotifer Diet BD
Pavlova
Isochrysis
Tetraselmis
TW

Storage and Feeding
Product FAQ
Choosing the Right Algae
Dry Weight
Nutritional / Proximate Profile
Product Safety
Live vs. Non-Viable
Live Starter Cultures
Microalgae Images
Use In Fish Hatcheries
Use In Shellfish Hatcheries
Use In Shrimp Hatcheries

Nannochloropsis

(www.Nannochloropsis.com) AEH-11-PSEUDO-02

ADD TO CART

AEH-11-PSEUDO-02

Nannochloropsis is a small green algae that is extensively used in the aquaculture industry for growing small zooplankton such as rotifers and for Greenwater. It is also used in reef tanks for feeding corals and other filter feeders. Instant Algae Nanno 3600® is 3600 X as dense as cultured algae, so 1 liter replaces almost 4 metric tons of live algae! Nanno 3600 is available in 1 quart and 1 pint bottles, and 1 liter bags.

Page 3 of 6

Fin Fish Hatcheries: Nannochloropsis is the single best food for growing rotifers. It has an very high EPA level and can be frozen for long term storage. It also works very well for Greenwater.

AEH-11-PSEUDO-02

Shellfish Hatcheries: Works very well with mussels. It has not been traditionally used with oysters and clams, however a study currently being done at a university in Los Angeles indicates that it can work as well or better than Isochrysis and Pavlova with larvae and post set. As soon as this study is complete we will post it on our website.

Storage: Instant Algae Nannochloropsis can be stored in a refrigerator for 3 months (best if stored at -1 to +3C) or it can be frozen for longer shelf life (2+ years). When frozen the algae will "hard-freeze" like ice.

Ice Cubes: If you have received a liter of Nanno and don't plan to use it all within 3 months we suggest making it into ice cubes. Simply pour the algae into a standard ice cube tray and freeze for 24 hours. Then take the cubes and store them in a plastic bag in your refrigerator. As you need more algae remove a cube from the plastic bag and thaw.

Source: CCMP525

For more information about our microalgae products please use the following links:

For Proximate Analysis (nuritional profile)
For information about feeding rotifers
For information about feeding shellfish
For a comparison of this algae to our other algae species
For information about Greenwater technique

Home

Compare Products
Product Sizes
** NEW **
Roti-Grow & N-Rich Products
****
Shellfish Diet
Nannochloropsis
Rotifer Diet HD
Pavlova
Isochrysis
Tetraselmis
TW

Storage and Feeding
Product FAQ
Choosing the Right Algae
Dry Weight
Nutritional / Proximate Profile
Product Safety
Live vs. Non-Viable
Live Starter Cultures
Microalgae Images
Use In Fish Hatcheries
Use In Shellfish Hatcheries
Use In Shrimp Hatcheries

AEH-11-PSEUDO-02

Tetraselmis

AEH-11-PSEUDO-02

www.Tetraselmis.com

ADD TO CART

Tetraselmis is a large green flagellate with a very high lipid level. It also contains natural amino acids that stimulate feeding in marine animals. It is an excellent feed for larval shrimp.

Fin Fish Hatcheries: Used in conjunction with Nannochloropsis for producing rotifers. It is also a good size for feeding brine shrimp.

Shellfish Hatcheries: A standard feed for oysters, clams, mussels, and scallops

Shrimp Hatcheries: An excellent feed for increasing growth rates and fighting "zoea syndrome".

Source: Private Lab

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For more information about our microalgae products please use the following links:

For Proximate Analysis (nuritional profile)

For information about feeding rotifers
For information about feeding shellfish
For a comparison of this algae to our other algae species
For information about Greenwater technique

Contact Us

871 East Hamilton Ave, Suite #D,
Campbell, CA 95008
Phone 408-377-1065 / Fax 408-377-3498
Office hours - 9 AM to 4 PM (California PST)

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AEH-11-PSEUDO-02

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Item No. 8
Pg 6 of 6

AEH-11-PSEUDO-02

Algae Stock Dry Weight Determination Procedure

Set drying oven to 65°C. Place metal weigh pans in drying oven for at least 1 hour. Remove weigh pans from drying oven and place into desiccator to cool for 1 hour. Calibrate analytical balance using appropriate weight set. Label pans with appropriate Pan IDs (e.g. N 1 for rep 1 of Nanno). Weigh pans and record pan tare weights on Algae Stock Dry Weight Determination Datasheet. Shake algae stock well. Add approximately 1g to each pan and record Pan + Diet Wet Weight on datasheet. Perform 6 reps for each algae stock. Initial/Date/Time appropriate section of datasheet. Place pans into drying oven to dry for 24 hours. Diet Wet Weight can be calculated by subtracting Pan Tare Weight from Pan + Diet Wet Weight.

After 24 hours, remove pans from drying oven and place into desiccator to cool for 1 hour. Calibrate analytical balance using appropriate weight set. Remove pans from desiccator and weigh them. Record 24 hour dry weights on datasheet. Place pans back into drying oven for another 24 hours. Initial/Date/Time appropriate section of datasheet.

After 48 total hours, remove pans from drying oven and place into desiccator to cool for 1 hour. Calibrate analytical balance with appropriate weight set. Remove pans from desiccator and weigh them. Record 48 hour dry weights on datasheet and discard pans. Initial/Date/Time appropriate section of datasheet.

Perform calculations on datasheet to achieve Mean Percent Dry Weight for each algae stock.

Equipment List:

Fisher Isotemp Oven, Model 255G, S/N 1757, room 122 (OVEN-1)

Sartorius Analytical Balance, Model 1712 MP8, S/N 3505049, room 122 (BAL-5)

Weight set, S/N 38951, room 122 (WTS-6)

Approved [redacted] 6/7/11

FF # 13
Item No. 9
Pg 1 of 1

Study Number AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 1/1-2 Proofed: KLW 19JAN12 Reviewed: JAL 11-21-14

Algae Stock Dry Weight Determination Datasheet

Algal Diet: Chlorella sorokiniana **Batch #:** N/A ; Bottle 1of 2 **Expiration Date:** 10JUL2011

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
C1	0.9878	1.9998	1.0120	1.0100	1.0097	1.00985	0.02205	2.18
C2	0.9899	2.0178	1.0279	1.0125	1.0120	1.01225	0.02235	2.17
C3	1.0055	2.0364	1.0309	1.0279	1.0275	1.0277	0.0222	2.15
C4	0.9830	2.0305	1.0475	1.0060	1.0056	1.0058	0.0228	2.18
C5	0.9700	2.0387	1.0687	0.9932	0.9929	0.99305	0.02305	2.16
C6	0.9882	2.0142	1.0260	1.0106	1.0101	1.01035	0.02215	2.16

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TJS / 24MAY11 / 1035

24 h Dry Weight: TJS / 25MAY11 / 1040

48 h Dry Weight: TJS / 26MAY11 / 1330

FF # 13a
Item No. 1
Pg 1 of 3

Balance: BAL-5 **Weight Set(s):** WTS-6 **Drying Oven / Temperature(°C):** OVEN-1 / 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 2.17

Version 1.0 / 23MAY2011 Approved by [redacted] Date: 23MAY2011

File Folder: 134 Lab book/pgs: 1/1-2 Proofed: KLW 19JAN12 Reviewed: SRC 11-21-11

Algae Stock Dry Weight Determination Datasheet

Algal Diet: Nanno 3600 **Batch #:** 11112 **Expiration Date:** 22 OCT 2011

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
N1	0.9904	2.0896	1.0992	1.2088	1.2074	1.2081	0.2177	19.81
N2	0.9621	2.0341	1.0720	1.1748	1.1740	1.1744	0.2123	19.80
N3	0.9986	2.0269	1.0283	1.2031	1.2019	1.2025	0.2039	19.83
N4	0.9788	2.0117	1.0329	1.1843	1.1831	1.1837	0.2049	19.84
N5	0.9753	1.9964	1.0211	1.1779	1.1768	1.17735	0.20205	19.79
N6	0.9665	1.9879	1.0214	1.1698	1.1688	1.1693	0.2028	19.86

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TJS / 24MAY11 / 1045

24 h Dry Weight: TJS / 25MAY11 / 1045

48 h Dry Weight: TJS / 26MAY11 / 1335

FF # 13a
Item No. 1
Pg 2 of 3

Balance: BAL-5 **Weight Set(s):** WTS-6 **Drying Oven / Temperature(°C):** OVEN-1 / 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 19.82

Version 1.0 / 23MAY2011 Approved by [redacted] Date: 23 MAY 2011

Study Number AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 1/1-2 Proofed: KLW 19JAN12 Reviewed: JN 11-21-14

Algae Stock Dry Weight Determination Datasheet

Algal Diet: Tetra Selmis 3600 **Batch #:** 11089 **Expiration Date:** 24 JUL 2011

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
T1	0.9793	1.9958	1.0165	1.1565	1.1560	1.15625	0.17695	17.41
T2	1.0014	2.0227	1.0213	1.1795	1.1789	1.1792	0.1778	17.41
T3	0.9891	2.0139	1.0248	1.1674	1.1671	1.16725	0.17815	17.38
T4	0.9663	1.9748	1.0085	1.1415	1.1410	1.14125	0.17495	17.35
T5	0.9842	1.9953	1.0111	1.1584	1.1578	1.1581	0.1739	17.20
T6	0.9690	1.9886	1.0196	1.1453	1.1449	1.1451	0.1761	17.27

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TDS / 24MAY11 / 1055

24 h Dry Weight: TDS / 25MAY11 / 1050

48 h Dry Weight: TDS / 26MAY11 / 1340

FF # 13a
Item No. 1
Pg 3 of 3

Balance: BAL-5 **Weight Set(s):** WTS-6 **Drying Oven / Temperature(°C):** OVEN-1 / 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 17.34

Version 1.0 / 23MAY2011 Approved by [redacted] Date: 23 MAY 2011

Study .ber AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 1/3-4 Proofed: JJS 19JAN12 Reviewed: JTC 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella sorokiniana **Batch #:** Harvested 31MAY 2011 **Expiration Date:** 30 AUG 11

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
C1	0.97952	2.03547	1.05595	1.01005	1.01001	1.01003	0.03051	2.89
C2	0.97111	2.07479	1.10368	1.00295	1.00306	1.003005	0.031895	2.89
C3	0.9639	2.04237	1.07847	0.99529	0.99546	0.995375	0.031475	2.92
C4	0.96281	1.98380	1.02099	0.99243	0.99240	0.992415	0.029605	2.90
C5	0.97886	2.01245	1.03359	1.00886	1.00881	1.008835	0.029975	2.90
C6	0.98056	1.98936	1.00880	1.00984	1.00989	1.009865	0.029305	2.90

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: KLW / 3 JUNE 11 / 1400

24 h Dry Weight: JKW / 4 JUNE 2011 / 1403

48 h Dry Weight: JKW / 5 JUN 2011 / 1400

FF # 13a
Item No. 8
Pg 1 of 1

Balance: BAL 5 **Weight Set(s):** WTS 6 **Drying Oven / Temperature(°C):** Oven 1 / 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 2.90

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/3/11

Study .ber AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 1/36-38 Proofed: TJS 17JAN12 Reviewed: JLC 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella **Batch #:** Recieved 17JUN11 bottle 2 of 2 **Expiration Date:** 8/30/11

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
C-1	0.9627	1.9908	1.0281	0.9890	0.9890	0.9890	0.0263	2.56
C-2	0.9752	2.0269	1.0517	1.0026	1.0024	1.0025	0.0273	2.60
C-3	1.0041	2.0244	1.0203	1.0303	1.0302	1.0303	0.0262	2.57
C-4	1.0179	2.0471	1.0292	1.0445	1.0447	1.0446	0.0267	2.59
C-5	0.9972	1.9973	1.0001	1.0230	1.0225	~~1.00~~ 1.0228 ②	0.0256	2.56
C-6	0.9860	2.0268	1.0408	1.0128	1.0127	1.0128	0.0268	2.57

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: JTV / 23JUN11 / 1322

24 h Dry Weight: JTV / 24JUN11 / 1338

48 h Dry Weight: KLW / 25JUN11 / 1040

FF # 13a
Item No. 3
Pg 1 of 1

Balance: BAL 5 **Weight Set(s):** WTS 6 **Drying Oven / Temperature(°C):** ~~BAT~~ OVEN 1 ① / 65 °C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 2.58

① Recording Error. TJS 23JUN11

② Recording Error KLW 25JUN11

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/3/11

Study .ber AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 1/47-49, 2/1 Proofed: TJS 19JAN12 KLW 19JAN12 Reviewed: J... 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella **Batch #:** Received: 14JUN11 **Expiration Date:** 14AUG11

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
C1	1.2326	2.2773	1.0447	1.2515	1.2513	1.2514	0.0188	1.80
C2	1.2284	2.2298	1.0014	1.2472	1.2466	1.2469	0.0185	1.85
C3	1.2168	2.2210	1.0042	1.2352	1.2346	1.2349	0.0181	1.80
C4	1.2065	2.2118	1.0053	1.2251	1.2245	1.2248	0.0183	1.82
C5	1.2193	2.2774	1.0581	1.2388	1.2383	1.2386	0.0193	1.82
C6	1.2160	2.2686	1.0526	1.2352	1.2347	1.2350	0.0190	1.80

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TJS / 05JUL11 / 0748

24 h Dry Weight: TJS / 06JUL11 / 0745

48 h Dry Weight: KLW / 07JUL11 / 0855

FF # 13a
Item No. 4
Pg 1 of 1

Balance: BAL 5 **Weight Set(s):** WTS 6 **Drying Oven / Temperature(°C):** OVEN 1 / 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 1.81

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/3/11

Study . .oer AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 2/24,25 Proofed: KLW 19JAN12 Reviewed: JM 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella **Batch #:** Received, 6DEC11 **Expiration Date:** 6MAR12

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
C1	1.30545	2.33178	1.02633	1.32487	1.32483	1.32486	0.01941	1.89
C2	1.30052	2.32974	1.02922	1.31983	1.31993	1.31988	0.01936	1.88
C3	1.29725	2.30575	1.00850	1.31639	1.31640	1.316395	0.019145	1.90
C4	1.31019	2.33353	1.02334	1.32938	1.32957	1.329475	0.019285	1.88
C5	1.29298	2.31720	1.02422	1.31258	1.31252	1.31255	0.01957	1.91
C6	1.30404	2.30072	0.99668	1.32349	1.32344	1.323465	0.019425	1.95

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TJS / 6DEC11 / 1335

24 h Dry Weight: TJS / 7DEC11 / 1335

48 h Dry Weight: TJS / 8DEC11 / 1330

FF # 13A
Item No. 5
Pg 1 of 3

Balance: BAL-5 **Weight Set(s):** WTS-6 **Drying Oven / Temperature(°C):** OVEN-1, 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 1.90%

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/7/11

Study . .oer AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 2/24,25 Proofed: KLW 19JAN12 Reviewed: JSL 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Nanno 3600 **Batch #:** 11302 **Expiration Date:** April 2012

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
N1	1.29892	2.32261	1.02369	1.50839	1.50755	1.50797	0.20905	20.42
N2	1.31193	~~2.32~~ (1) 2.33344	1.02151	1.52191	1.52087	1.52139	0.20946	20.50
N3	1.30181	2.31803	1.01622	1.51089	1.50996	1.510425	0.208615	20.53
N4	1.30311	2.33469	1.03158	1.51436	1.51390	1.51413	0.21102	20.46
N5	1.29635	2.32020	1.02385	1.50639	1.50569	1.50604	0.20969	20.48
N6	1.30992	2.32175	1.01183	1.51789	1.51712	1.517505	0.207585	20.52

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TJS / 6DEC11 / 1325

(1) Recording Error. 2.33344 is correct. TJS 6DEC11

24 h Dry Weight: TJS / 7DEC11 / 1330

48 h Dry Weight: TJS / 8DEC11 / 1325

FF # 13A
Item No. 5
Pg 2 of 3

Balance: BAL-5 **Weight Set(s):** WTS-6 **Drying Oven / Temperature(°C):** OVEN-1 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 20.48 %

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/3/11

Study ɹer AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 2/~~24~~ 24,25 (KLW 14DEC11) Proofed: KLW 19JAN12 Reviewed: JAL 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Tetraselmis **Batch #:** Batch # 11089 opened: 06DEC11 **Expiration Date:** APRIL 2012

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
T1	1.30567	2.32115	1.01548	1.48877	1.48769	1.48823	0.18256	17.98
T2	1.30337	2.32422	1.02085	1.48737	1.48633	1.48685	0.18348	17.97
T3	1.29677	2.32701	1.03024	1.48220	1.48097	1.481585	0.184815	17.94
T4	1.29424	2.29665	1.00241	1.47371	1.47290	1.473305	0.179065	17.86
T5	1.29791	2.30511	1.00720	1.47830	1.47728	1.47779	0.17988	17.86
T6	1.29683	2.30132	1.00449	1.47798	1.47676	1.47737	0.18054	17.97

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: TDS / 6DEC11 / 1315

24 h Dry Weight: TDS / 7DEC11 / 1325

48 h Dry Weight: TDS / 8DEC11 / 1320

FF # 13a
Item No. 5
Pg 3 of 3

Balance: BAL-5 **Weight Set(s):** WTS6 **Drying Oven / Temperature(°C):** OVEN-1 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 17.93 %

Version 1.0 / 23MAY2011 Approved by: [redacted] Date: 6/3/11

Study Number AEH-11-PSEUDO-02

File Folder: ~~13B~~ 13A wrong file folder KW 23 APR12 Lab book/pgs: 2/32-33 Reviewed: KW 7NOV14 Verified: JH 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella **Batch #:** 50.4 g algal paste in 500 mL well water **Expiration Date:** 24 APR12

Feeding Chart: 1.5 and 1.6 **Species:** FAM **System:** 1

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
1	1.3055	~~2.6944~~ ①	1.3864	1.3308	1.3310	1.3309	0.0254	1.83
2	1.3018	2.3865	1.0847	1.3215	1.3214	1.32145	0.0197	1.82
3	1.3119	2.3272	1.0153	1.3304	1.3304	1.3304	0.0185	1.82
4	1.3085	2.3526	1.0441	1.3273	1.3274	1.32735	0.01885	1.81
5	1.3093	2.3330	1.0237	1.3278	1.3277	1.32775	0.0185	1.81
6	1.3050	2.3468	1.0418	1.3233	1.3233	1.3233	0.0183	1.76

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: KW / 24JAN12/ 1446   ① RE. Should be 2.6919 g KW 24JAN12

24 h Dry Weight: KW / 25JAN12/ 1545

48 h Dry Weight: KW / 26JAN12/ 1515

FF # 13A
Item No. 6
Pg 1 of 1

Balance: BAL5 **Weight Set(s):** WTS6 **Drying Oven / Temperature(°C):** OVEN-1 / 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 1.81

Version 1.1/11JAN2012   This datasheet was approved by [redacted] on 12JAN2012.

Study Number AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 2/38-39 Reviewed: KLW 23APR12 Verified: JAL 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Nanno 3600 **Batch #:*** 12031 **Expiration Date:** SEP2012

Feeding Chart: Version 1.7 **Species:** BLS **System:** 2

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
N1	1.07481	2.07609	1.00128	1.27853	1.27853	1.27853	~~1.1895~~ ③	20.35
N2	1.07766	2.07733	0.99967	1.28079	1.28093	1.28086	0.2032	~~20.34~~ ④
N3	1.06220	2.06260	1.0004	1.26575	1.26580	1.26578	0.20358	20.35
N4	1.09809	2.09457	0.99648	1.30016	1.30046	1.30031	0.20222	20.29
N5	1.06815	① ~~1.00~~	0.99129	1.27154	1.27145	1.271495	0.20335	20.51
N6	1.05563	2.05614	1.00051	1.25985	~~1.2600~~ ②	1.259995	0.20437	20.43

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: JKW / 29MAR12 1135

24 h Dry Weight: JKW / 30MAR12 / 1355

48 h Dry Weight: KLW / 31MAR12 / 1440

② Balance changed. 1.26004g KLW 31MAR12

③ wrong dry weight. Should be 0.20372g KLW 31MAR12

④ wrong %. Should be 20.33% KLW 31MAR12

FF # 13a
Item No. 7
Pg 1 of 2

Balance: BAL-7 **Weight Set(s):** WTS-3 **Drying Oven / Temperature(°C):** 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 20.38%

① Pan + Diet wet weight = 2.05944g. JKW 29MAR12

Version 1.1/11JAN2012 This datasheet was approved by [redacted] on 12JAN2012.

Study N[redacted]er AEH-11-PSEUDO-02

File Folder: 13A Lab book/pgs: 2/38-39 Reviewed: KW 7NOV14 Verified: JAL 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Tetraselmis 3600 **Batch #:** 11139 **Expiration Date:** SEP 2012

Feeding Chart: version 1.7 **Species:** BLS **System:** 2

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
T1	1.06864	2.06705	0.99841	1.24410	1.24304	1.24357	0.17493	17.52
T2	1.06337	2.06378	1.00041	1.23938	1.23914	1.23926	0.17589	17.58
T3	1.08605	2.08411	0.99806	1.26055	1.25973	1.26014	0.17409	17.44
T4	1.07724	2.07701	0.99977	1.25107	1.24779	1.24943	0.17219	17.22
T5	1.07758	2.07760	1.00002	1.25100	1.25017	1.250585	0.17297	17.30
T6	1.04377	2.04645	1.00268	1.21693	1.21664	1.216785	0.173015	17.26

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: JKW / 29MAR12 / 1250

24 h Dry Weight: JKW / 30MAR12 / 1345

48 h Dry Weight: KW / 31MAR12 / 1440

FF # 13a
~~Item No.~~ 7
Pg 2 of 2

Balance: BAL-7 **Weight Set(s):** WTS-3 **Drying Oven / Temperature(°C):** 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 17.39

Version 1.1/11JAN2012 This datasheet was approved by [redacted] on 12JAN2012.

Study ı ɹer AEH-11-PSEUDO-02

File Folder: 13 A Lab book/pgs: 2/39 Reviewed: KLW 23APR12 Verified: JL 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella **Batch #:** 1 of 1 **Expiration Date:** Exp. 07/2012

Feeding Chart: Version 1.7 **Species:** BLS **System:** 2

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
C1	1.29399	2.29199	0.99800	1.31452	1.31449	1.314505	0.020515	2.0556
C2	1.29971	2.29677	0.99706	1.31911	1.31910	1.319105	0.019395	1.9452
C3	1.29888	2.29764	0.99876	1.31970	1.31964	1.319670	0.020790	2.0815
C4	1.28998	2.28905	0.99907	1.30919	1.30923	1.309210	0.019230	1.9247
C5	1.29535	2.29412	0.99877	1.31397	1.31390	1.313935	0.018585	1.8607
C6	1.29720	2.29575	0.99855	1.31446	1.31439	1.314425	0.017225	1.7250

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: JKW / 11APR12 / 1515

24 h Dry Weight: TRS / 12APR12 / 1505

48 h Dry Weight: JKW / 13APR12 / 1515

FF # 13A Item No. 8 Pg 1 of 1

Balance: BAL-7 **Weight Set(s):** WTS-03 **Drying Oven / Temperature(°C):** 65°C

Mean Percent Dry Weight [Sum of column I, divided by 6]: 1.93%

Version 1.1/11JAN2012 This datasheet was approved by [redacted] on 12JAN2012.

Study I... ...er AEH-11-PSEUDO-02

File Folder: 13a Lab book/pgs: 2/45 Reviewed: KW 11MAY12 Verified: JR 11-21-14

Individual Algae Product Dry Weight Determination Datasheet

Algal Diet: Chlorella **Batch #:** 1of1 recived 10MAY12 **Expiration Date:** AUG 2012

Feeding Chart: Version 1.8 **Species:** PPB **System:** 1

A	B	C	D	E	F	G	H	I
Pan ID	Pan Tare Weight (g)	Pan + Diet Wet Weight (g)	Diet Wet Weight (g) [C-B]	24 h Pan + Diet Dry Weight (g)	48 h Pan + Diet Dry Weight (g)	Pan + Diet Mean Dry Weight (g) [(E+F)/2]	Diet Mean Dry Weight (g) [G-B]	Percent Dry Weight (H/D)*100
1	1.2935	2.3177	1.0242	1.3129	1.31258	1.312740	0.019240	1.878539
2	1.2958	2.3676	1.0718	1.3160	1.31559	1.315795	0.019995	1.865563
3	1.2928	2.3186	1.0258	1.3121	1.31185	1.31975	0.019175	1.869273
4	1.2922	2.3971	1.1049	1.3129	1.31271	1.312805	0.020605	1.864875
5	1.2969	2.3332	1.0363	1.3163	1.31589	1.316095	0.019195	1.852263
6	1.2956	2.3230	1.0274	1.3149	1.31481	1.314855	0.019255	1.874148

Initials/Date/Time (military): To be filled out by data collector determining weights at each respective time point.

Pan Tare Weight/Wet Weight: KW / 10MAY12 / 1030

24 h Dry Weight: KW / 11MAY12 / 1130

48 h Dry Weight: JRL / 5/12/12 / 1045

Balance: BAL 7 (Rm 17A) **Weight Set(s):** 13046 (Rm 2) **Drying Oven / Temperature(°C):** 65°C (Rm 15)

Mean Percent Dry Weight [Sum of column I, divided by 6]: 1.867442%

FF # 13a
Item No. 9
Pg 1 of 1

Version 1.1/11JAN2012 This datasheet was approved by [redacted] on 12JAN2012.

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 6/3/11

File Folder 13B Book 1 p. 3-4, 8, 12/1/2011

Algae Stock Preparation Chart

Version 1.0 Effective Date 6/7/11 Initials Jn

PROOFED BY Initials: Date:
REVIEWED BY Initials: Date:
not needed for inventory

Chlorella Dry wt **2.17 %**
Nanno Dry wt **19.82 %**
Tetra Dry wt **17.34 %**
Delivery pump setting **2.0 mL/min**

FF # 13b
Item No. 1
Pg 1 **of** 2

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	407.7	18.79	2.06	2.35
301	541.8	2.0	3.6	545.4	409.1	18.85	2.06	2.36
302	543.6	2.0	3.6	547.2	410.4	18.91	2.07	2.37
303	545.4	2.0	3.6	549.0	411.8	18.97	2.08	2.37
304	547.2	2.0	3.6	550.8	413.1	19.04	2.08	2.38
305	549.0	2.0	3.6	552.6	414.5	19.10	2.09	2.39
306	550.8	2.0	3.6	554.4	415.8	19.16	2.10	2.40
307	552.6	2.0	3.6	556.2	417.2	19.22	2.10	2.41
308	554.4	2.0	3.6	558.0	418.5	19.29	2.11	2.41
309	556.2	2.0	3.6	559.8	419.9	19.35	2.12	2.42
310	558.0	2.0	3.6	561.6	421.2	19.41	2.13	2.43
311	559.8	2.0	3.6	563.4	422.6	19.47	2.13	2.44
312	561.6	2.0	3.6	565.2	423.9	19.53	2.14	2.44
313	563.4	2.0	3.6	567.0	425.3	19.60	2.15	2.45
314	565.2	2.0	3.6	568.8	426.6	19.66	2.15	2.46
315	567.0	2.0	3.6	570.6	428.0	19.72	2.16	2.47
316	568.8	2.0	3.6	572.4	429.3	19.78	2.17	2.48
317	570.6	2.0	3.6	574.2	430.7	19.85	2.17	2.48
318	572.4	2.0	3.6	576.0	432.0	19.91	2.18	2.49
319	574.2	2.0	3.6	577.8	433.4	19.97	2.19	2.50
320	576.0	2.0	3.6	579.6	434.7	20.03	2.19	2.51
321	577.8	2.0	3.6	581.4	436.1	20.09	2.20	2.51
322	579.6	2.0	3.6	583.2	437.4	20.16	2.21	2.52

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	438.8	20.22	2.21	2.53
324	583.2	2.0	3.6	586.8	440.1	20.28	2.22	2.54
325	585.0	2.0	3.6	588.6	441.5	20.34	2.23	2.55
326	586.8	2.0	3.6	590.4	442.8	20.41	2.23	2.55
327	588.6	2.0	3.6	592.2	444.2	20.47	2.24	2.56
328	590.4	2.0	3.6	594.0	445.5	20.53	2.25	2.57
329	592.2	2.0	3.6	595.8	446.9	20.59	2.25	2.58
330	594.0	2.0	3.6	597.6	448.2	20.65	2.26	2.58
331	595.8	2.0	3.6	599.4	449.6	20.72	2.27	2.59
332	597.6	2.0	3.6	601.2	450.9	20.78	2.27	2.60
333	599.4	2.0	3.6	603.0	452.3	20.84	2.28	2.61
334	601.2	2.0	3.6	604.8	453.6	20.90	2.29	2.62
335	603.0	2.0	3.6	606.6	455.0	20.97	2.30	2.62
336	604.8	2.0	3.6	608.4	456.3	21.03	2.30	2.63
337	606.6	2.0	3.6	610.2	457.7	21.09	2.31	2.64
338	608.4	2.0	3.6	612.0	459.0	21.15	2.32	2.65
339	610.2	2.0	3.6	613.8	460.4	21.21	2.32	2.65
340	612.0	2.0	3.6	615.6	461.7	21.28	2.33	2.66

Log Book / Pages 1/3-4
File Folder 13B
Initials Nw Date 7Nov14

FF # 132
Item No. 1
Pg 2 of 2

PROOFED BY
Initials: Date
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Initials: Date
not needed Nw 7Nov14

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 6/6/11

File Folder 13B
Book 1 p. 5, 7, 11, 19, 22, 23, 24, 25, 26, 27, 28

Algae Stock Preparation Chart

Version 1.1a Effective Date 6/6/11 Initials JW

Chlorella Dry wt	2.9 %
Nanno Dry wt	19.82 %
Tetra Dry wt	17.34 %
Delivery pump setting	2.0 mL/min

FF # 13b
Item No. 2
Pg 1 of 2

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Initials: ___ Date: ___
not needed [illegible]

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	407.7	14.06	2.06	2.35
301	541.8	2.0	3.6	545.4	409.1	14.11	2.06	2.36
302	543.6	2.0	3.6	547.2	410.4	14.15	2.07	2.37
303	545.4	2.0	3.6	549.0	411.8	14.20	2.08	2.37
304	547.2	2.0	3.6	550.8	413.1	14.24	2.08	2.38
305	549.0	2.0	3.6	552.6	414.5	14.29	2.09	2.39
306	550.8	2.0	3.6	554.4	415.8	14.34	2.10	2.40
307	552.6	2.0	3.6	556.2	417.2	14.38	2.10	2.41
308	554.4	2.0	3.6	558.0	418.5	14.43	2.11	2.41
309	556.2	2.0	3.6	559.8	419.9	14.48	2.12	2.42
310	558.0	2.0	3.6	561.6	421.2	14.52	2.13	2.43
311	559.8	2.0	3.6	563.4	422.6	14.57	2.13	2.44
312	561.6	2.0	3.6	565.2	423.9	14.62	2.14	2.44
313	563.4	2.0	3.6	567.0	425.3	14.66	2.15	2.45
314	565.2	2.0	3.6	568.8	426.6	14.71	2.15	2.46
315	567.0	2.0	3.6	570.6	428.0	14.76	2.16	2.47
316	568.8	2.0	3.6	572.4	429.3	14.80	2.17	2.48
317	570.6	2.0	3.6	574.2	430.7	14.85	2.17	2.48
318	572.4	2.0	3.6	576.0	432.0	14.90	2.18	2.49
319	574.2	2.0	3.6	577.8	433.4	14.94	2.19	2.50
320	576.0	2.0	3.6	579.6	434.7	14.99	2.19	2.51
321	577.8	2.0	3.6	581.4	436.1	15.04	2.20	2.51
322	579.6	2.0	3.6	583.2	437.4	15.08	2.21	2.52

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	438.8	15.13	2.21	2.53
324	583.2	2.0	3.6	586.8	440.1	15.18	2.22	2.54
325	585.0	2.0	3.6	588.6	441.5	15.22	2.23	2.55
326	586.8	2.0	3.6	590.4	442.8	15.27	2.23	2.55
327	588.6	2.0	3.6	592.2	444.2	15.32	2.24	2.56
328	590.4	2.0	3.6	594.0	445.5	15.36	2.25	2.57
329	592.2	2.0	3.6	595.8	446.9	15.41	2.25	2.58
330	594.0	2.0	3.6	597.6	448.2	15.46	2.26	2.58
331	595.8	2.0	3.6	599.4	449.6	15.50	2.27	2.59
332	597.6	2.0	3.6	601.2	450.9	15.55	2.27	2.60
333	599.4	2.0	3.6	603.0	452.3	15.59	2.28	2.61
334	601.2	2.0	3.6	604.8	453.6	15.64	2.29	2.62
335	603.0	2.0	3.6	606.6	455.0	15.69	2.30	2.62
336	604.8	2.0	3.6	608.4	456.3	15.73	2.30	2.63
337	606.6	2.0	3.6	610.2	457.7	15.78	2.31	2.64
338	608.4	2.0	3.6	612.0	459.0	15.83	2.32	2.65
339	610.2	2.0	3.6	613.8	460.4	15.87	2.32	2.65
340	612.0	2.0	3.6	615.6	461.7	15.92	2.33	2.66

Log Book / Pages 1/5,7,11,19,22-28
File Folder 13B
Initials JM Date 3NOV11

FF # 132
Item No. 2
Pg 2 of 2

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Initials: ____ Date: ____
REVIEWED BY
Initials: ____ Date: ____

not needed JM 3Nov11

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 6/17/11

File Folder 13B
Book 1 p. 29, 30, 31, 33, 34, 35-36, 37, 38, 39

Algae Stock Preparation Chart

Version 1.1b Effective Date 6/17/11 Initials JAL

Chlorella Dry wt	**2.9 %**
Nanno Dry wt	**19.82 %**
Tetra Dry wt	**17.34 %**
Delivery pump setting	**2.0 mL/min**

FF # 13b
Item No. 3
Pg 1 of 2

PROOFED BY
Initials: ____ Date ____
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Initials: ____ Date: ____

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Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	12.50	1.83	2.09
301	541.8	2.0	3.6	545.4	363.6	12.54	1.83	2.10
302	543.6	2.0	3.6	547.2	364.8	12.58	1.84	2.10
303	545.4	2.0	3.6	549.0	366.0	12.62	1.85	2.11
304	547.2	2.0	3.6	550.8	367.2	12.66	1.85	2.12
305	549.0	2.0	3.6	552.6	368.4	12.70	1.86	2.12
306	550.8	2.0	3.6	554.4	369.6	12.74	1.86	2.13
307	552.6	2.0	3.6	556.2	370.8	12.79	1.87	2.14
308	554.4	2.0	3.6	558.0	372.0	12.83	1.88	2.15
309	556.2	2.0	3.6	559.8	373.2	12.87	1.88	2.15
310	558.0	2.0	3.6	561.6	374.4	12.91	1.89	2.16
311	559.8	2.0	3.6	563.4	375.6	12.95	1.90	2.17
312	561.6	2.0	3.6	565.2	376.8	12.99	1.90	2.17
313	563.4	2.0	3.6	567.0	378.0	13.03	1.91	2.18
314	565.2	2.0	3.6	568.8	379.2	13.08	1.91	2.19
315	567.0	2.0	3.6	570.6	380.4	13.12	1.92	2.19
316	568.8	2.0	3.6	572.4	381.6	13.16	1.93	2.20
317	570.6	2.0	3.6	574.2	382.8	13.20	1.93	2.21
318	572.4	2.0	3.6	576.0	384.0	13.24	1.94	2.21
319	574.2	2.0	3.6	577.8	385.2	13.28	1.94	2.22
320	576.0	2.0	3.6	579.6	386.4	13.32	1.95	2.23
321	577.8	2.0	3.6	581.4	387.6	13.37	1.96	2.24
322	579.6	2.0	3.6	583.2	388.8	13.41	1.96	2.24

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	390.0	13.45	1.97	2.25
324	583.2	2.0	3.6	586.8	391.2	13.49	1.97	2.26
325	585.0	2.0	3.6	588.6	392.4	13.53	1.98	2.26
326	586.8	2.0	3.6	590.4	393.6	13.57	1.99	2.27
327	588.6	2.0	3.6	592.2	394.8	13.61	1.99	2.28
328	590.4	2.0	3.6	594.0	396.0	13.66	2.00	2.28
329	592.2	2.0	3.6	595.8	397.2	13.70	2.00	2.29
330	594.0	2.0	3.6	597.6	398.4	13.74	2.01	2.30
331	595.8	2.0	3.6	599.4	399.6	13.78	2.02	2.30
332	597.6	2.0	3.6	601.2	400.8	13.82	2.02	2.31
333	599.4	2.0	3.6	603.0	402.0	13.86	2.03	2.32
334	601.2	2.0	3.6	604.8	403.2	13.90	2.03	2.33
335	603.0	2.0	3.6	606.6	404.4	13.94	2.04	2.33
336	604.8	2.0	3.6	608.4	405.6	13.99	2.05	2.34
337	606.6	2.0	3.6	610.2	406.8	14.03	2.05	2.35
338	608.4	2.0	3.6	612.0	408.0	14.07	2.06	2.35
339	610.2	2.0	3.6	613.8	409.2	14.11	2.06	2.36
340	612.0	2.0	3.6	615.6	410.4	14.15	2.07	2.37

Log Book / Pages 1/29-31, 33-39
File Folder 13B
Initials [illegible] Date [illegible]

FF # 13b
Item No. 3
Pg 2 of 2

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Initials: Date
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Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 6/27/11

File Folder 13B
Book 1
p. 40, 41, 42, 43, 45, 46, 47, 48

Algae Stock Preparation Chart

Version 1.2 Effective Date 6/27/11 Initials

Chlorella Dry wt 2.58 %
Nanno Dry wt 19.82 %
Tetra Dry wt 17.34 %
Delivery pump setting 2.0 mL/min

FF # 13b
Item No. 4
Pg 1 of 2

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	14.05	1.83	2.09
301	541.8	2.0	3.6	545.4	363.6	14.09	1.83	2.10
302	543.6	2.0	3.6	547.2	364.8	14.14	1.84	2.10
303	545.4	2.0	3.6	549.0	366.0	14.19	1.85	2.11
304	547.2	2.0	3.6	550.8	367.2	14.23	1.85	2.12
305	549.0	2.0	3.6	552.6	368.4	14.28	1.86	2.12
306	550.8	2.0	3.6	554.4	369.6	14.33	1.86	2.13
307	552.6	2.0	3.6	556.2	370.8	14.37	1.87	2.14
308	554.4	2.0	3.6	558.0	372.0	14.42	1.88	2.15
309	556.2	2.0	3.6	559.8	373.2	14.47	1.88	2.15
310	558.0	2.0	3.6	561.6	374.4	14.51	1.89	2.16
311	559.8	2.0	3.6	563.4	375.6	14.56	1.90	2.17
312	561.6	2.0	3.6	565.2	376.8	14.60	1.90	2.17
313	563.4	2.0	3.6	567.0	378.0	14.65	1.91	2.18
314	565.2	2.0	3.6	568.8	379.2	14.70	1.91	2.19
315	567.0	2.0	3.6	570.6	380.4	14.74	1.92	2.19
316	568.8	2.0	3.6	572.4	381.6	14.79	1.93	2.20
317	570.6	2.0	3.6	574.2	382.8	14.84	1.93	2.21
318	572.4	2.0	3.6	576.0	384.0	14.88	1.94	2.21
319	574.2	2.0	3.6	577.8	385.2	14.93	1.94	2.22
320	576.0	2.0	3.6	579.6	386.4	14.98	1.95	2.23
321	577.8	2.0	3.6	581.4	387.6	15.02	1.96	2.24
322	579.6	2.0	3.6	583.2	388.8	15.07	1.96	2.24

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

					0.0			
					0.0			
323	581.4	2.0	3.6	585.0	390.0	15.12	1.97	2.25
324	583.2	2.0	3.6	586.8	391.2	15.16	1.97	2.26
325	585.0	2.0	3.6	588.6	392.4	15.21	1.98	2.26
326	586.8	2.0	3.6	590.4	393.6	15.26	1.99	2.27
327	588.6	2.0	3.6	592.2	394.8	15.30	1.99	2.28
328	590.4	2.0	3.6	594.0	396.0	15.35	2.00	2.28
329	592.2	2.0	3.6	595.8	397.2	15.40	2.00	2.29
330	594.0	2.0	3.6	597.6	398.4	15.44	2.01	2.30
331	595.8	2.0	3.6	599.4	399.6	15.49	2.02	2.30
332	597.6	2.0	3.6	601.2	400.8	15.53	2.02	2.31
333	599.4	2.0	3.6	603.0	402.0	15.58	2.03	2.32
334	601.2	2.0	3.6	604.8	403.2	15.63	2.03	2.33
335	603.0	2.0	3.6	606.6	404.4	15.67	2.04	2.33
336	604.8	2.0	3.6	608.4	405.6	15.72	2.05	2.34
337	606.6	2.0	3.6	610.2	406.8	15.77	2.05	2.35
338	608.4	2.0	3.6	612.0	408.0	15.81	2.06	2.35
339	610.2	2.0	3.6	613.8	409.2	15.86	2.06	2.36
340	612.0	2.0	3.6	615.6	410.4	15.91	2.07	2.37

Log Book / Pages 1/40-43,45-48
File Folder 13B
Initials kws Date 7Nov14

FF # 13b
Item No. 9
Pg 2 of 2

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~~REVIEWED~~
~~Initials: Date:~~
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kws 7Nov14

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 7/7/11

File Folder 13B
Book 1
p. 50
Book 2
p. 1, 3, 6, 10, 13, 16, 17, 18, 19, 21

Algae Stock Preparation Chart

Version 1.3 Effective Date 7/7/2011 Initials KLW

Chlorella Dry wt **1.81 %**
Nanno Dry wt **19.82 %**
Tetra Dry wt **17.34 %**
Delivery pump setting **2.0 mL/min**

FF # 13b
Item No. 5
Pg 1 of 2

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Initials: Date:
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Initials: Date:
not needed

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	20.02	1.83	2.09
301	541.8	2.0	3.6	545.4	363.6	20.09	1.83	2.10
302	543.6	2.0	3.6	547.2	364.8	20.15	1.84	2.10
303	545.4	2.0	3.6	549.0	366.0	20.22	1.85	2.11
304	547.2	2.0	3.6	550.8	367.2	20.29	1.85	2.12
305	549.0	2.0	3.6	552.6	368.4	20.35	1.86	2.12
306	550.8	2.0	3.6	554.4	369.6	20.42	1.86	2.13
307	552.6	2.0	3.6	556.2	370.8	20.49	1.87	2.14
308	554.4	2.0	3.6	558.0	372.0	20.55	1.88	2.15
309	556.2	2.0	3.6	559.8	373.2	20.62	1.88	2.15
310	558.0	2.0	3.6	561.6	374.4	20.69	1.89	2.16
311	559.8	2.0	3.6	563.4	375.6	20.75	1.90	2.17
312	561.6	2.0	3.6	565.2	376.8	20.82	1.90	2.17
313	563.4	2.0	3.6	567.0	378.0	20.88	1.91	2.18
314	565.2	2.0	3.6	568.8	379.2	20.95	1.91	2.19
315	567.0	2.0	3.6	570.6	380.4	21.02	1.92	2.19
316	568.8	2.0	3.6	572.4	381.6	21.08	1.93	2.20
317	570.6	2.0	3.6	574.2	382.8	21.15	1.93	2.21
318	572.4	2.0	3.6	576.0	384.0	21.22	1.94	2.21
319	574.2	2.0	3.6	577.8	385.2	21.28	1.94	2.22
320	576.0	2.0	3.6	579.6	386.4	21.35	1.95	2.23
321	577.8	2.0	3.6	581.4	387.6	21.41	1.96	2.24
322	579.6	2.0	3.6	583.2	388.8	21.48	1.96	2.24

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

					0.0			
					0.0			
323	581.4	2.0	3.6	585.0	390.0	21.55	1.97	2.25
324	583.2	2.0	3.6	586.8	391.2	21.61	1.97	2.26
325	585.0	2.0	3.6	588.6	392.4	21.68	1.98	2.26
326	586.8	2.0	3.6	590.4	393.6	21.75	1.99	2.27
327	588.6	2.0	3.6	592.2	394.8	21.81	1.99	2.28
328	590.4	2.0	3.6	594.0	396.0	21.88	2.00	2.28
329	592.2	2.0	3.6	595.8	397.2	21.94	2.00	2.29
330	594.0	2.0	3.6	597.6	398.4	22.01	2.01	2.30
331	595.8	2.0	3.6	599.4	399.6	22.08	2.02	2.30
332	597.6	2.0	3.6	601.2	400.8	22.14	2.02	2.31
333	599.4	2.0	3.6	603.0	402.0	22.21	2.03	2.32
334	601.2	2.0	3.6	604.8	403.2	22.28	2.03	2.33
335	603.0	2.0	3.6	606.6	404.4	22.34	2.04	2.33
336	604.8	2.0	3.6	608.4	405.6	22.41	2.05	2.34
337	606.6	2.0	3.6	610.2	406.8	22.48	2.05	2.35
338	608.4	2.0	3.6	612.0	408.0	22.54	2.06	2.35
339	610.2	2.0	3.6	613.8	409.2	22.61	2.06	2.36
340	612.0	2.0	3.6	615.6	410.4	22.67	2.07	2.37

Log Book / Pages 1/50, 2/1,3,6,10,13,16,17,18,19,21
File Folder 13 B
Initials Kmw Date 7NOV14

FF # 13b
Item No. 5
Pg 2 of 2

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Initials: Date:
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Initials: Date:
not needed
kmw
7NOV14

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 08 DEC 2011

Algae Stock Preparation Chart

File Folder 13B
Book 2
pgs 26, 28-31

Version 1.4 Effective Date 08 DEC 2011 Initials [illegible]

Chlorella Dry wt	**1.9 %**
Nanno Dry wt	**20.48 %**
Tetra Dry wt	**17.93 %**
Delivery pump setting	**2.0 mL/min**

FF # 13b
Item No. 6
Pg 1 of 2

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:
not needed [illegible]

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	19.07	1.77	2.02
301	541.8	2.0	3.6	545.4	363.6	19.14	1.78	2.03
302	543.6	2.0	3.6	547.2	364.8	19.20	1.78	2.03
303	545.4	2.0	3.6	549.0	366.0	19.26	1.79	2.04
304	547.2	2.0	3.6	550.8	367.2	19.33	1.79	2.05
305	549.0	2.0	3.6	552.6	368.4	19.39	1.80	2.05
306	550.8	2.0	3.6	554.4	369.6	19.45	1.80	2.06
307	552.6	2.0	3.6	556.2	370.8	19.52	1.81	2.07
308	554.4	2.0	3.6	558.0	372.0	19.58	1.82	2.07
309	556.2	2.0	3.6	559.8	373.2	19.64	1.82	2.08
310	558.0	2.0	3.6	561.6	374.4	19.71	1.83	2.09
311	559.8	2.0	3.6	563.4	375.6	19.77	1.83	2.09
312	561.6	2.0	3.6	565.2	376.8	19.83	1.84	2.10
313	563.4	2.0	3.6	567.0	378.0	19.89	1.85	2.11
314	565.2	2.0	3.6	568.8	379.2	19.96	1.85	2.11
315	567.0	2.0	3.6	570.6	380.4	20.02	1.86	2.12
316	568.8	2.0	3.6	572.4	381.6	20.08	1.86	2.13
317	570.6	2.0	3.6	574.2	382.8	20.15	1.87	2.13
318	572.4	2.0	3.6	576.0	384.0	20.21	1.88	2.14
319	574.2	2.0	3.6	577.8	385.2	20.27	1.88	2.15
320	576.0	2.0	3.6	579.6	386.4	20.34	1.89	2.16
321	577.8	2.0	3.6	581.4	387.6	20.40	1.89	2.16
322	579.6	2.0	3.6	583.2	388.8	20.46	1.90	2.17

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

					0.0			
					0.0			
323	581.4	2.0	3.6	585.0	390.0	20.53	1.90	2.18
324	583.2	2.0	3.6	586.8	391.2	20.59	1.91	2.18
325	585.0	2.0	3.6	588.6	392.4	20.65	1.92	2.19
326	586.8	2.0	3.6	590.4	393.6	20.72	1.92	2.20
327	588.6	2.0	3.6	592.2	394.8	20.78	1.93	2.20
328	590.4	2.0	3.6	594.0	396.0	20.84	1.93	2.21
329	592.2	2.0	3.6	595.8	397.2	20.91	1.94	2.22
330	594.0	2.0	3.6	597.6	398.4	20.97	1.95	2.22
331	595.8	2.0	3.6	599.4	399.6	21.03	1.95	2.23
332	597.6	2.0	3.6	601.2	400.8	21.09	1.96	2.24
333	599.4	2.0	3.6	603.0	402.0	21.16	1.96	2.24
334	601.2	2.0	3.6	604.8	403.2	21.22	1.97	2.25
335	603.0	2.0	3.6	606.6	404.4	21.28	1.97	2.26
336	604.8	2.0	3.6	608.4	405.6	21.35	1.98	2.26
337	606.6	2.0	3.6	610.2	406.8	21.41	1.99	2.27
338	608.4	2.0	3.6	612.0	408.0	21.47	1.99	2.28
339	610.2	2.0	3.6	613.8	409.2	21.54	2.00	2.28
340	612.0	2.0	3.6	615.6	410.4	21.60	2.00	2.29

Log Book / Pages 2/25, 28-31
File Folder 158
Initials mw Date 7Nov14

PROOFED BY
Initials: Date:
REVIEWED BY
Initials: Date:

not needed mw 7Nov14

FF # 136
Item No. 6
Pg 2 of 2

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 25 JAN 2012.

Algae Stock Preparation Chart

Version 1.5 Effective Date 25 JAN 2012 Initials KLW

File Folder 13B
Book 2
Pgs. 32, 35-37

Chlorella Dry wt	**1.8 %**		
Nanno Dry wt	**20.48 %**	FF # 13b	
Tetra Dry wt	**17.93 %**	Item No. 7	
Delivery pump setting	**2.0 mL/min**	Pg 1 of 2	

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Initials: ______ Date: ______
REVIEWED BY
Initials: ______ Date: ______
not needed KLW FROM

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	20.13	1.77	2.02
301	541.8	2.0	3.6	545.4	363.6	20.20	1.78	2.03
302	543.6	2.0	3.6	547.2	364.8	20.27	1.78	2.03
303	545.4	2.0	3.6	549.0	366.0	20.33	1.79	2.04
304	547.2	2.0	3.6	550.8	367.2	20.40	1.79	2.05
305	549.0	2.0	3.6	552.6	368.4	20.47	1.80	2.05
306	550.8	2.0	3.6	554.4	369.6	20.53	1.80	2.06
307	552.6	2.0	3.6	556.2	370.8	20.60	1.81	2.07
308	554.4	2.0	3.6	558.0	372.0	20.67	1.82	2.07
309	556.2	2.0	3.6	559.8	373.2	20.73	1.82	2.08
310	558.0	2.0	3.6	561.6	374.4	20.80	1.83	2.09
311	559.8	2.0	3.6	563.4	375.6	20.87	1.83	2.09
312	561.6	2.0	3.6	565.2	376.8	20.93	1.84	2.10
313	563.4	2.0	3.6	567.0	378.0	21.00	1.85	2.11
314	565.2	2.0	3.6	568.8	379.2	21.07	1.85	2.11
315	567.0	2.0	3.6	570.6	380.4	21.13	1.86	2.12
316	568.8	2.0	3.6	572.4	381.6	21.20	1.86	2.13
317	570.6	2.0	3.6	574.2	382.8	21.27	1.87	2.13
318	572.4	2.0	3.6	576.0	384.0	21.33	1.88	2.14
319	574.2	2.0	3.6	577.8	385.2	21.40	1.88	2.15
320	576.0	2.0	3.6	579.6	386.4	21.47	1.89	2.16
321	577.8	2.0	3.6	581.4	387.6	21.53	1.89	2.16
322	579.6	2.0	3.6	583.2	388.8	21.60	1.90	2.17

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	390.0	21.67	1.90	2.18
324	583.2	2.0	3.6	586.8	391.2	21.73	1.91	2.18
325	585.0	2.0	3.6	588.6	392.4	21.80	1.92	2.19
326	586.8	2.0	3.6	590.4	393.6	21.87	1.92	2.20
327	588.6	2.0	3.6	592.2	394.8	21.93	1.93	2.20
328	590.4	2.0	3.6	594.0	396.0	22.00	1.93	2.21
329	592.2	2.0	3.6	595.8	397.2	22.07	1.94	2.22
330	594.0	2.0	3.6	597.6	398.4	22.13	1.95	2.22
331	595.8	2.0	3.6	599.4	399.6	22.20	1.95	2.23
332	597.6	2.0	3.6	601.2	400.8	22.27	1.96	2.24
333	599.4	2.0	3.6	603.0	402.0	22.33	1.96	2.24
334	601.2	2.0	3.6	604.8	403.2	22.40	1.97	2.25
335	603.0	2.0	3.6	606.6	404.4	22.47	1.97	2.26
336	604.8	2.0	3.6	608.4	405.6	22.53	1.98	2.26
337	606.6	2.0	3.6	610.2	406.8	22.60	1.99	2.27
338	608.4	2.0	3.6	612.0	408.0	22.67	1.99	2.28
339	610.2	2.0	3.6	613.8	409.2	22.73	2.00	2.28
340	612.0	2.0	3.6	615.6	410.4	22.80	2.00	2.29

Log Book / Pages 2/32, 35-37
File Folder 138
Initials KW Date 7nov14

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Initials: Date :
REVIEWED BY
Initials: Date:
not needed
KW 7nov14

FF # 136
Item No. 7
Pg 2 of 2

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 27 JAN 2012

Log Book / Pages 2/34-35 33-34 wrong pages
File Folder 13 B
Initials [illegible] Date 7 NOV 14

Algae Stock Preparation Chart

Version 1.6 Effective Date 27 JAN 2012 Initials KLW

PROOFED BY
Initials: ___ Date: ___
REVIEWED BY
Initials: ___ Date: ___
not needed [illegible] 7 NOV 14

Chlorella Dry wt	**1.81 %**
Nanno Dry wt	**20.48 %**
Tetra Dry wt	**17.93 %**
Delivery pump setting	**2.0 mL/min**

FF # 13b
Item No. 8
Pg 1 of 2

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	20.02	1.77	2.02
301	541.8	2.0	3.6	545.4	363.6	20.09	1.78	2.03
302	543.6	2.0	3.6	547.2	364.8	20.15	1.78	2.03
303	545.4	2.0	3.6	549.0	366.0	20.22	1.79	2.04
304	547.2	2.0	3.6	550.8	367.2	20.29	1.79	2.05
305	549.0	2.0	3.6	552.6	368.4	20.35	1.80	2.05
306	550.8	2.0	3.6	554.4	369.6	20.42	1.80	2.06
307	552.6	2.0	3.6	556.2	370.8	20.49	1.81	2.07
308	554.4	2.0	3.6	558.0	372.0	20.55	1.82	2.07
309	556.2	2.0	3.6	559.8	373.2	20.62	1.82	2.08
310	558.0	2.0	3.6	561.6	374.4	20.69	1.83	2.09
311	559.8	2.0	3.6	563.4	375.6	20.75	1.83	2.09
312	561.6	2.0	3.6	565.2	376.8	20.82	1.84	2.10
313	563.4	2.0	3.6	567.0	378.0	20.88	1.85	2.11
314	565.2	2.0	3.6	568.8	379.2	20.95	1.85	2.11
315	567.0	2.0	3.6	570.6	380.4	21.02	1.86	2.12
316	568.8	2.0	3.6	572.4	381.6	21.08	1.86	2.13
317	570.6	2.0	3.6	574.2	382.8	21.15	1.87	2.13
318	572.4	2.0	3.6	576.0	384.0	21.22	1.88	2.14
319	574.2	2.0	3.6	577.8	385.2	21.28	1.88	2.15
320	576.0	2.0	3.6	579.6	386.4	21.35	1.89	2.16
321	577.8	2.0	3.6	581.4	387.6	21.41	1.89	2.16
322	579.6	2.0	3.6	583.2	388.8	21.48	1.90	2.17

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	390.0	21.55	1.90	2.18
324	583.2	2.0	3.6	586.8	391.2	21.61	1.91	2.18
325	585.0	2.0	3.6	588.6	392.4	21.68	1.92	2.19
326	586.8	2.0	3.6	590.4	393.6	21.75	1.92	2.20
327	588.6	2.0	3.6	592.2	394.8	21.81	1.93	2.20
328	590.4	2.0	3.6	594.0	396.0	21.88	1.93	2.21
329	592.2	2.0	3.6	595.8	397.2	21.94	1.94	2.22
330	594.0	2.0	3.6	597.6	398.4	22.01	1.95	2.22
331	595.8	2.0	3.6	599.4	399.6	22.08	1.95	2.23
332	597.6	2.0	3.6	601.2	400.8	22.14	1.96	2.24
333	599.4	2.0	3.6	603.0	402.0	22.21	1.96	2.24
334	601.2	2.0	3.6	604.8	403.2	22.28	1.97	2.25
335	603.0	2.0	3.6	606.6	404.4	22.34	1.97	2.26
336	604.8	2.0	3.6	608.4	405.6	22.41	1.98	2.26
337	606.6	2.0	3.6	610.2	406.8	22.48	1.99	2.27
338	608.4	2.0	3.6	612.0	408.0	22.54	1.99	2.28
339	610.2	2.0	3.6	613.8	409.2	22.61	2.00	2.28
340	612.0	2.0	3.6	615.6	410.4	22.67	2.00	2.29

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KW 7nov14

2 of 2

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 4/16/12

Algae Stock Preparation Chart

Version 1.7 Effective Date 14APR12 Initials VW 14APR12

Chlorella Dry wt 1.93 %
Nanno Dry wt 20.38 %
Tetra Dry wt 17.39 %
Delivery pump setting 2.0 mL/min

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Not needed VW 7NOV14

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	18.78	1.78	2.08
301	541.8	2.0	3.6	545.4	363.6	18.84	1.78	2.09
302	543.6	2.0	3.6	547.2	364.8	18.90	1.79	2.10
303	545.4	2.0	3.6	549.0	366.0	18.96	1.80	2.10
304	547.2	2.0	3.6	550.8	367.2	19.03	1.80	2.11
305	549.0	2.0	3.6	552.6	368.4	19.09	1.81	2.12
306	550.8	2.0	3.6	554.4	369.6	19.15	1.81	2.13
307	552.6	2.0	3.6	556.2	370.8	19.21	1.82	2.13
308	554.4	2.0	3.6	558.0	372.0	19.27	1.83	2.14
309	556.2	2.0	3.6	559.8	373.2	19.34	1.83	2.15
310	558.0	2.0	3.6	561.6	374.4	19.40	1.84	2.15
311	559.8	2.0	3.6	563.4	375.6	19.46	1.84	2.16
312	561.6	2.0	3.6	565.2	376.8	19.52	1.85	2.17
313	563.4	2.0	3.6	567.0	378.0	19.59	1.85	2.17
314	565.2	2.0	3.6	568.8	379.2	19.65	1.86	2.18
315	567.0	2.0	3.6	570.6	380.4	19.71	1.87	2.19
316	568.8	2.0	3.6	572.4	381.6	19.77	1.87	2.19
317	570.6	2.0	3.6	574.2	382.8	19.83	1.88	2.20
318	572.4	2.0	3.6	576.0	384.0	19.90	1.88	2.21
319	574.2	2.0	3.6	577.8	385.2	19.96	1.89	2.22
320	576.0	2.0	3.6	579.6	386.4	20.02	1.90	2.22
321	577.8	2.0	3.6	581.4	387.6	20.08	1.90	2.23
322	579.6	2.0	3.6	583.2	388.8	20.15	1.91	2.24

Study Number AEH-11-PSEUDO-02

Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	390.0	20.21	1.91	2.24
324	583.2	2.0	3.6	586.8	391.2	20.27	1.92	2.25
325	585.0	2.0	3.6	588.6	392.4	20.33	1.93	2.26
326	586.8	2.0	3.6	590.4	393.6	20.39	1.93	2.26
327	588.6	2.0	3.6	592.2	394.8	20.46	1.94	2.27
328	590.4	2.0	3.6	594.0	396.0	20.52	1.94	2.28
329	592.2	2.0	3.6	595.8	397.2	20.58	1.95	2.28
330	594.0	2.0	3.6	597.6	398.4	20.64	1.95	2.29
331	595.8	2.0	3.6	599.4	399.6	20.70	1.96	2.30
332	597.6	2.0	3.6	601.2	400.8	20.77	1.97	2.30
333	599.4	2.0	3.6	603.0	402.0	20.83	1.97	2.31
334	601.2	2.0	3.6	604.8	403.2	20.89	1.98	2.32
335	603.0	2.0	3.6	606.6	404.4	20.95	1.98	2.33
336	604.8	2.0	3.6	608.4	405.6	21.02	1.99	2.33
337	606.6	2.0	3.6	610.2	406.8	21.08	2.00	2.34
338	608.4	2.0	3.6	612.0	408.0	21.14	2.00	2.35
339	610.2	2.0	3.6	613.8	409.2	21.20	2.01	2.35
340	612.0	2.0	3.6	615.6	410.4	21.26	2.01	2.36

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Initials: Date:

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Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

Approved [redacted] **Date** 5/15/12

Algae Stock Preparation Chart

Version 1.8 Effective Date 14MAY12 Initials KW

Chlorella Dry wt	**1.87 %**
Nanno Dry wt	**20.38 %**
Tetra Dry wt	**17.39 %**
Delivery pump setting	**2.0 mL/min**

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Initials: Date:
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KW 7/...

Stock for each system prepared in 3,600 mL of well water

Flow Rate (mL/min)	Vol. Delivered 30 hrs (L)	Delivery pump Flow (mL/min)	Pump Vol 30 hrs (L)	Total vol through Headbox (30h [L])	Dry wt. algae required per type (mg)	Wet wt Chlorella required (g)	Wet wt Nanno required (g)	Wet wt Tetra required (g)
300	540.0	2.0	3.6	543.6	362.4	19.38	1.78	2.08
301	541.8	2.0	3.6	545.4	363.6	19.44	1.78	2.09
302	543.6	2.0	3.6	547.2	364.8	19.51	1.79	2.10
303	545.4	2.0	3.6	549.0	366.0	19.57	1.80	2.10
304	547.2	2.0	3.6	550.8	367.2	19.64	1.80	2.11
305	549.0	2.0	3.6	552.6	368.4	19.70	1.81	2.12
306	550.8	2.0	3.6	554.4	369.6	19.76	1.81	2.13
307	552.6	2.0	3.6	556.2	370.8	19.83	1.82	2.13
308	554.4	2.0	3.6	558.0	372.0	19.89	1.83	2.14
309	556.2	2.0	3.6	559.8	373.2	19.96	1.83	2.15
310	558.0	2.0	3.6	561.6	374.4	20.02	1.84	2.15
311	559.8	2.0	3.6	563.4	375.6	20.09	1.84	2.16
312	561.6	2.0	3.6	565.2	376.8	20.15	1.85	2.17
313	563.4	2.0	3.6	567.0	378.0	20.21	1.85	2.17
314	565.2	2.0	3.6	568.8	379.2	20.28	1.86	2.18
315	567.0	2.0	3.6	570.6	380.4	20.34	1.87	2.19
316	568.8	2.0	3.6	572.4	381.6	20.41	1.87	2.19
317	570.6	2.0	3.6	574.2	382.8	20.47	1.88	2.20
318	572.4	2.0	3.6	576.0	384.0	20.53	1.88	2.21
319	574.2	2.0	3.6	577.8	385.2	20.60	1.89	2.22
320	576.0	2.0	3.6	579.6	386.4	20.66	1.90	2.22
321	577.8	2.0	3.6	581.4	387.6	20.73	1.90	2.23
322	579.6	2.0	3.6	583.2	388.8	20.79	1.91	2.24

Study Number AEH-11-PSEUDO-02
Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species

323	581.4	2.0	3.6	585.0	390.0	20.86	1.91	2.24
324	583.2	2.0	3.6	586.8	391.2	20.92	1.92	2.25
325	585.0	2.0	3.6	588.6	392.4	20.98	1.93	2.26
326	586.8	2.0	3.6	590.4	393.6	21.05	1.93	2.26
327	588.6	2.0	3.6	592.2	394.8	21.11	1.94	2.27
328	590.4	2.0	3.6	594.0	396.0	21.18	1.94	2.28
329	592.2	2.0	3.6	595.8	397.2	21.24	1.95	2.28
330	594.0	2.0	3.6	597.6	398.4	21.30	1.95	2.29
331	595.8	2.0	3.6	599.4	399.6	21.37	1.96	2.30
332	597.6	2.0	3.6	601.2	400.8	21.43	1.97	2.30
333	599.4	2.0	3.6	603.0	402.0	21.50	1.97	2.31
334	601.2	2.0	3.6	604.8	403.2	21.56	1.98	2.32
335	603.0	2.0	3.6	606.6	404.4	21.63	1.98	2.33
336	604.8	2.0	3.6	608.4	405.6	21.69	1.99	2.33
337	606.6	2.0	3.6	610.2	406.8	21.75	2.00	2.34
338	608.4	2.0	3.6	612.0	408.0	21.82	2.00	2.35
339	610.2	2.0	3.6	613.8	409.2	21.88	2.01	2.35
340	612.0	2.0	3.6	615.6	410.4	21.95	2.01	2.36

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Appendix 8. Juvenile Mussel Survival Summary and Statistical Analysis

Study Number: AEH-11-PSEUDO-02	Action	Date	Initials
Data Source: File Folders: 11a-11g	Created......	6-May-14	KLW
Form: "Juvenile Mussel Recovery Datasheet"	Revised......	19-Nov-14	KLW
	Reviewed...	12/1/14	
	Certified...	11/21/14	JR
File Name: I:\AEH-11-PSEUDO-02\Data\[PSEUDO-02 Juvenile Survival for SAS.xlsx]Survival			

Juvenile Mussel Survival

Species, Dosing, and Assessment Information

Scientific Name	Common Name	Abbreviation	Formulation Type	Test Article Lot Number	Exposure Date	Assessment Date
Obovaria olivaria	Hickorynut	HIC	FDP	110510FD	12-Jul-11	20-Jul-11
Actinonaias ligamentina	Mucket	MUC	FDP	110510FD	14-Jul-11	22-Jul-11
Megalonaias nervosa	Washboard	WAS	FDP	110928FD	13-Dec-11	21-Dec-11
Lampsilis siliquoidea	Fatmucket	FAM	SDP	MBI-401 SDP 4655-12-Mix	27-Jan-12	4-Feb-12
Ligumia recta	Black sandshell	BLS	SDP	TR4669-4-(7-8) 2nd shipment	17-Apr-12	25-Apr-12
Lampsilis cardium	Plain pocketbook	PPB	SDP	TR4669-4-(5)	16-May-12	24-May-12
Lampsilis higginsii	Higgins eye	HGE	SDP	TR4669-4-(5)	26-May-12	3-Jun-12

Data codes used within SAS

sps = Juvenile mussel species (see 3 letter abbreviation codes above)
form = Product formulation
  FDP = Freeze dried powder
  SDP = Spray dried powder
conc = Concentration (mg/L)
  0 = Control (no product added)
  50 = 50 mg/L active ingredient
  100 = 100 mg/L active ingredient
  200 = 200 mg/L active ingredient
  300 = 300 mg/L active ingredient
  400 = 300 mg/L deactive ingredient
cham = Exposure chamber ID
  i.e., 1A2 = Test system (1, 2, or 3); Block ID (A or B), and Position in Block (1-12)
tot = Total number of juvenile mussels placed in chamber prior to exposure (n = 40)
rec = Number of recovered juvenile mussels during assessment
via = Number of viable juvenile mussels from the recovered mussels
dead = Number of dead juvenile mussels (= rec - via)
unrec = Number of animals not recovered during the assessment (= tot - rec)
tdead = Total number of dead animals including unrecovered (= dead + unrec)

Data Analysis Explanation

Statistical comparisons of juvenile mussel survival were performed using SAS Version 9.4 (SAS Institute, Inc., Cary, North Carolina). A generalized linear mixed model (Proc GLIMMIX) was used to analyze the survival of juvenile mussels in each treatment. The proportion of mortalities (number of dead and unrecovered juvenile mussels/total number juvenile mussels placed) was modeled with a binomial distribution and a logit link function. A scale parameter was added to the model using the random_residual_ statement. Juvenile mussel survival of each treatment group was individually compared to the survival in the non-treated control group using a two-sided means comparison test with a Tukey post-hoc adjustment.

Data Anomalies and Deviations

NONE

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Item Number 2
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sps	form	conc	cham	tot	rec	via	dead	unrec	tdead
HIC	FDP	0	1A2	40	34	26	8	6	14
HIC	FDP	0	1A5	40	34	34	0	6	6
HIC	FDP	0	1B2	40	38	29	9	2	11
HIC	FDP	0	1B12	40	35	26	9	5	14
HIC	FDP	400	1A8	40	35	17	18	5	23
HIC	FDP	400	1A10	40	37	20	17	3	20
HIC	FDP	400	1B6	40	37	28	9	3	12
HIC	FDP	400	1B7	40	32	20	12	8	20
HIC	FDP	50	1A4	40	37	31	6	3	9
HIC	FDP	50	1A7	40	39	28	11	1	12
HIC	FDP	50	1B9	40	28	14	14	12	26
HIC	FDP	50	1B11	40	38	31	7	2	9
HIC	FDP	100	1A6	40	38	21	17	2	19
HIC	FDP	100	1A9	40	37	33	4	3	7
HIC	FDP	100	1B3	40	31	22	9	9	18
HIC	FDP	100	1B10	40	38	32	6	2	8
HIC	FDP	200	1A1	40	34	27	7	6	13
HIC	FDP	200	1A11	40	38	28	10	2	12
HIC	FDP	200	1B5	40	35	8	27	5	32
HIC	FDP	200	1B8	40	38	21	17	2	19
HIC	FDP	300	1A3	40	40	20	20	0	20
HIC	FDP	300	1A12	40	38	12	26	2	28
HIC	FDP	300	1B1	40	33	9	24	7	31
HIC	FDP	300	1B4	40	40	20	20	0	20
MUC	FDP	0	2A4	40	38	34	4	2	6
MUC	FDP	0	2A11	40	39	36	3	1	4
MUC	FDP	0	2B7	40	36	28	8	4	12
MUC	FDP	0	2B10	40	30	28	2	10	12
MUC	FDP	400	2A8	40	39	34	5	1	6
MUC	FDP	400	2A12	40	38	31	7	2	9
MUC	FDP	400	2B1	40	37	33	4	3	7
MUC	FDP	400	2B6	40	37	33	4	3	7
MUC	FDP	50	2A3	40	38	32	6	2	8
MUC	FDP	50	2B5	40	39	28	11	1	12
MUC	FDP	50	2B9	40	38	34	4	2	6
MUC	FDP	50	2A10	40	35	31	4	5	9
MUC	FDP	100	2B8	40	32	26	6	8	14
MUC	FDP	100	2B3	40	39	34	5	1	6
MUC	FDP	100	2A6	40	33	26	7	7	14
MUC	FDP	100	2A7	40	40	34	6	0	6
MUC	FDP	200	2A1	40	39	31	8	1	9
MUC	FDP	200	2A5	40	38	32	6	2	8
MUC	FDP	200	2B11	40	39	24	15	1	16
MUC	FDP	200	2B12	40	35	25	10	5	15
MUC	FDP	300	2B2	40	38	29	9	2	11
MUC	FDP	300	2B4	40	37	29	8	3	11

MUC	FDP	300	2A2	40	38	25	13	2	15
MUC	FDP	300	2A9	40	37	35	2	3	5
WAS	FDP	0	2A9	40	39	37	2	1	3
WAS	FDP	0	2A11	40	39	35	4	1	5
WAS	FDP	0	2B1	40	38	37	1	2	3
WAS	FDP	0	2B7	40	39	32	7	1	8
WAS	FDP	400	2A5	40	38	26	12	2	14
WAS	FDP	400	2A7	40	40	34	6	0	6
WAS	FDP	400	2B5	40	35	28	7	5	12
WAS	FDP	400	2B8	40	38	34	4	2	6
WAS	FDP	50	2A1	40	38	33	5	2	7
WAS	FDP	50	2A12	40	34	28	6	6	12
WAS	FDP	50	2B2	40	37	33	4	3	7
WAS	FDP	50	2B11	40	39	30	9	1	10
WAS	FDP	100	2A2	40	37	34	3	3	6
WAS	FDP	100	2A3	40	36	31	5	4	9
WAS	FDP	100	2B9	40	39	36	3	1	4
WAS	FDP	100	2B12	40	39	37	2	1	3
WAS	FDP	200	2A6	40	37	27	10	3	13
WAS	FDP	200	2A10	40	36	31	5	4	9
WAS	FDP	200	2B3	40	40	35	5	0	5
WAS	FDP	200	2B10	40	41	35	6	-1	5
WAS	FDP	300	2A4	40	38	17	21	2	23
WAS	FDP	300	2A8	40	39	17	22	1	23
WAS	FDP	300	2B4	40	38	26	12	2	14
WAS	FDP	300	2B6	40	39	17	22	1	23
FAM	SDP	0	1B5	40	37	34	3	3	6
FAM	SDP	0	1A1	40	37	34	3	3	6
FAM	SDP	0	1B10	40	37	37	0	3	3
FAM	SDP	0	1A7	40	35	35	0	5	5
FAM	SDP	400	1B2	40	38	33	5	2	7
FAM	SDP	400	1A6	40	35	5	30	5	35
FAM	SDP	400	1B8	40	35	2	33	5	38
FAM	SDP	400	1A8	40	38	8	30	2	32
FAM	SDP	50	1B1	40	34	23	11	6	17
FAM	SDP	50	1B6	40	39	35	4	1	5
FAM	SDP	50	1A3	40	36	29	7	4	11
FAM	SDP	50	1A9	40	37	34	3	3	6
FAM	SDP	100	1B3	40	40	36	4	0	4
FAM	SDP	100	1A2	40	37	31	6	3	9
FAM	SDP	100	1B11	40	38	35	3	2	5
FAM	SDP	100	1A11	40	39	36	3	1	4
FAM	SDP	200	1A5	40	36	13	23	4	27
FAM	SDP	200	1B7	40	37	23	14	3	17
FAM	SDP	200	1A12	40	36	31	5	4	9
FAM	SDP	200	1B9	40	38	14	24	2	26
FAM	SDP	300	1A4	40	36	1	35	4	39

FAM	SDP	300	1B4	40	38	0	38	2	40
FAM	SDP	300	1A10	40	37	2	35	3	38
FAM	SDP	300	1B12	40	36	3	33	4	37
BLS	SDP	0	2A6	40	38	3	35	2	37
BLS	SDP	0	2A8	40	35	11	24	5	29
BLS	SDP	0	2B9	40	36	16	20	4	24
BLS	SDP	0	2B11	40	40	10	30	0	30
BLS	SDP	50	2A9	40	38	3	35	2	37
BLS	SDP	50	2A12	40	36	12	24	4	28
BLS	SDP	50	2B5	40	38	2	36	2	38
BLS	SDP	50	2B8	40	37	17	20	3	23
BLS	SDP	100	2A3	40	37	3	34	3	37
BLS	SDP	100	2A5	40	39	3	36	1	37
BLS	SDP	100	2B2	40	34	1	33	6	39
BLS	SDP	100	2B7	40	38	3	35	2	37
BLS	SDP	200	2A1	40	39	4	35	1	36
BLS	SDP	200	2A4	40	36	3	33	4	37
BLS	SDP	200	2B6	40	40	0	40	0	40
BLS	SDP	200	2B12	40	35	6	29	5	34
BLS	SDP	300	2A10	40	36	6	30	4	34
BLS	SDP	300	2A11	40	38	4	34	2	36
BLS	SDP	300	2B1	40	40	8	32	0	32
BLS	SDP	300	2B4	40	35	4	31	5	36
BLS	SDP	400	2A2	40	38	0	38	2	40
BLS	SDP	400	2A7	40	38	1	37	2	39
BLS	SDP	400	2B3	40	38	0	38	2	40
BLS	SDP	400	2B10	40	38	10	28	2	30
PPB	SDP	0	1A1	40	36	32	4	4	8
PPB	SDP	0	1A3	40	34	23	11	6	17
PPB	SDP	0	1B9	40	39	29	10	1	11
PPB	SDP	0	1B10	40	37	26	11	3	14
PPB	SDP	400	1A2	40	34	21	13	6	19
PPB	SDP	400	1A4	40	37	6	31	3	34
PPB	SDP	400	1B1	40	37	24	13	3	16
PPB	SDP	400	1B4	40	36	14	22	4	26
PPB	SDP	50	1A8	40	35	6	29	5	34
PPB	SDP	50	1A10	40	38	10	28	2	30
PPB	SDP	50	1B3	40	38	4	34	2	36
PPB	SDP	50	1B8	40	34	3	31	6	37
PPB	SDP	100	1A6	40	38	11	27	2	29
PPB	SDP	100	1A7	40	38	7	31	2	33
PPB	SDP	100	1B5	40	32	10	22	8	30
PPB	SDP	100	1B7	40	38	2	36	2	38
PPB	SDP	200	1A5	40	36	6	30	4	34
PPB	SDP	200	1A11	40	36	9	27	4	31
PPB	SDP	200	1B6	40	36	5	31	4	35
PPB	SDP	200	1B12	40	39	23	16	1	17

PPB	SDP	300	1A9	40	34	10	24	6	30
PPB	SDP	300	1A12	40	38	14	24	2	26
PPB	SDP	300	1B2	40	33	5	28	7	35
PPB	SDP	300	1B11	40	39	1	38	1	39
HGE	SDP	0	1A1	40	36	31	5	4	9
HGE	SDP	0	1A8	40	35	33	2	5	7
HGE	SDP	0	1B1	40	38	38	0	2	2
HGE	SDP	0	1B8	40	40	39	1	0	1
HGE	SDP	400	1A5	40	36	24	12	4	16
HGE	SDP	400	1A7	40	39	31	8	1	9
HGE	SDP	400	1B7	40	38	36	2	2	4
HGE	SDP	400	1B11	40	38	30	8	2	10
HGE	SDP	50	1A6	40	37	35	2	3	5
HGE	SDP	50	1A10	40	30	27	3	10	13
HGE	SDP	50	1B4	40	37	31	6	3	9
HGE	SDP	50	1B10	40	37	34	3	3	6
HGE	SDP	100	1A3	40	38	33	5	2	7
HGE	SDP	100	1A9	40	36	31	5	4	9
HGE	SDP	100	1B3	40	34	29	5	6	11
HGE	SDP	100	1B9	40	40	33	7	0	7
HGE	SDP	200	1A4	40	28	19	9	12	21
HGE	SDP	200	1A11	40	40	30	10	0	10
HGE	SDP	200	1B2	40	32	25	7	8	15
HGE	SDP	200	1B5	40	38	31	7	2	9
HGE	SDP	300	1A2	40	35	25	10	5	15
HGE	SDP	300	1A12	40	30	26	4	10	14
HGE	SDP	300	1B6	40	39	21	18	1	19
HGE	SDP	300	1B12	40	36	27	9	4	13

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Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels from seven different unionid species exposure to various concentrations of Pf-CL145A
SAS v. 9.4 Analysis completion date: 27 February 2014 Analysis prepared by: KLW
All Juvenile Mussel Survival Data

KLW 27FEB15

AEH-11-PSEUDO-02

Obs	sps	form	conc	cham	tot	rec	via	dead	unrec	tdead	pctsurv	pctmort	pctrec
1	BLS	SDP	0	2A6	40	38	3	35	2	37	7.5	92.5	95.0
2	BLS	SDP	0	2A8	40	35	11	24	5	29	27.5	72.5	87.5
3	BLS	SDP	0	2B9	40	36	16	20	4	24	40.0	60.0	90.0
4	BLS	SDP	0	2B11	40	40	10	30	0	30	25.0	75.0	100.0
5	BLS	SDP	50	2A9	40	38	3	35	2	37	7.5	92.5	95.0
6	BLS	SDP	50	2A12	40	36	12	24	4	28	30.0	70.0	90.0
7	BLS	SDP	50	2B5	40	38	2	36	2	38	5.0	95.0	95.0
8	BLS	SDP	50	2B8	40	37	17	20	3	23	42.5	57.5	92.5
9	BLS	SDP	100	2A3	40	37	3	34	3	37	7.5	92.5	92.5
10	BLS	SDP	100	2A5	40	39	3	36	1	37	7.5	92.5	97.5
11	BLS	SDP	100	2B2	40	34	1	33	6	39	2.5	97.5	85.0
12	BLS	SDP	100	2B7	40	38	3	35	2	37	7.5	92.5	95.0
13	BLS	SDP	200	2A1	40	39	4	35	1	36	10.0	90.0	97.5
14	BLS	SDP	200	2A4	40	36	3	33	4	37	7.5	92.5	90.0
15	BLS	SDP	200	2B6	40	40	0	40	0	40	0.0	100.0	100.0
16	BLS	SDP	200	2B12	40	35	6	29	5	34	15.0	85.0	87.5
17	BLS	SDP	300	2A10	40	36	6	30	4	34	15.0	85.0	90.0
18	BLS	SDP	300	2A11	40	38	4	34	2	36	10.0	90.0	95.0
19	BLS	SDP	300	2B1	40	40	8	32	0	32	20.0	80.0	100.0
20	BLS	SDP	300	2B4	40	35	4	31	5	36	10.0	90.0	87.5
21	BLS	SDP	400	2A2	40	38	0	38	2	40	0.0	100.0	95.0
22	BLS	SDP	400	2A7	40	38	1	37	2	39	2.5	97.5	95.0
23	BLS	SDP	400	2B3	40	38	0	38	2	40	0.0	100.0	95.0
24	BLS	SDP	400	2B10	40	38	10	28	2	30	25.0	75.0	95.0
25	FAM	SDP	0	1B5	40	37	34	3	3	6	85.0	15.0	92.5
26	FAM	SDP	0	1A1	40	37	34	3	3	6	85.0	15.0	92.5
27	FAM	SDP	0	1B10	40	37	37	0	3	3	92.5	7.5	92.5
28	FAM	SDP	0	1A7	40	35	35	0	5	5	87.5	12.5	87.5
29	FAM	SDP	50	1B1	40	34	23	11	6	17	57.5	42.5	85.0
30	FAM	SDP	50	1B6	40	39	35	4	1	5	87.5	12.5	97.5
31	FAM	SDP	50	1A3	40	36	29	7	4	11	72.5	27.5	90.0
32	FAM	SDP	50	1A9	40	37	34	3	3	6	85.0	15.0	92.5
33	FAM	SDP	100	1B3	40	40	36	4	0	4	90.0	10.0	100.0
34	FAM	SDP	100	1A2	40	37	31	6	3	9	77.5	22.5	92.5
35	FAM	SDP	100	1B11	40	38	35	3	2	5	87.5	12.5	95.0

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36	FAM	SDP	100	1A11	40	39	36	3	1	4	90.0	10.0	97.5
37	FAM	SDP	200	1A5	40	36	13	23	4	27	32.5	67.5	90.0
38	FAM	SDP	200	1B7	40	37	23	14	3	17	57.5	42.5	92.5
39	FAM	SDP	200	1A12	40	36	31	5	4	9	77.5	22.5	90.0
40	FAM	SDP	200	1B9	40	38	14	24	2	26	35.0	65.0	95.0
41	FAM	SDP	300	1A4	40	36	1	35	4	39	2.5	97.5	90.0
42	FAM	SDP	300	1B4	40	38	0	38	2	40	0.0	100.0	95.0
43	FAM	SDP	300	1A10	40	37	2	35	3	38	5.0	95.0	92.5
44	FAM	SDP	300	1B12	40	36	3	33	4	37	7.5	92.5	90.0
45	FAM	SDP	400	1B2	40	38	33	5	2	7	82.5	17.5	95.0
46	FAM	SDP	400	1A6	40	35	5	30	5	35	12.5	87.5	87.5
47	FAM	SDP	400	1B8	40	35	2	33	5	38	5.0	95.0	87.5
48	FAM	SDP	400	1A8	40	38	8	30	2	32	20.0	80.0	95.0
49	HGE	SDP	0	1A1	40	36	31	5	4	9	77.5	22.5	90.0
50	HGE	SDP	0	1A8	40	35	33	2	5	7	82.5	17.5	87.5
51	HGE	SDP	0	1B1	40	38	38	0	2	2	95.0	5.0	95.0
52	HGE	SDP	0	1B6	40	40	39	1	0	1	97.5	2.5	100.0
53	HGE	SDP	50	1A6	40	37	35	2	3	5	87.5	12.5	92.5
54	HGE	SDP	50	1A10	40	30	27	3	10	13	67.5	32.5	75.0
55	HGE	SDP	50	1B4	40	37	31	6	3	9	77.5	22.5	92.5
56	HGE	SDP	50	1B10	40	37	34	3	3	6	85.0	15.0	92.5
57	HGE	SDP	100	1A3	40	38	33	5	2	7	82.5	17.5	95.0
58	HGE	SDP	100	1A9	40	36	31	5	4	9	77.5	22.5	90.0
59	HGE	SDP	100	1B3	40	34	29	5	6	11	72.5	27.5	85.0
60	HGE	SDP	100	1B9	40	40	33	7	0	7	82.5	17.5	100.0
61	HGE	SDP	200	1A4	40	28	19	9	12	21	47.5	52.5	70.0
62	HGE	SDP	200	1A11	40	40	30	10	0	10	75.0	25.0	100.0
63	HGE	SDP	200	1B2	40	32	25	7	8	15	62.5	37.5	80.0
64	HGE	SDP	200	1B5	40	38	31	7	2	9	77.5	22.5	95.0
65	HGE	SDP	300	1A2	40	35	25	10	5	15	62.5	37.5	87.5
66	HGE	SDP	300	1A12	40	30	26	4	10	14	65.0	35.0	75.0
67	HGE	SDP	300	1B6	40	39	21	18	1	19	52.5	47.5	97.5
68	HGE	SDP	300	1B12	40	36	27	9	4	13	67.5	32.5	90.0
69	HGE	SDP	400	1A5	40	36	24	12	4	16	60.0	40.0	90.0
70	HGE	SDP	400	1A7	40	39	31	8	1	9	77.5	22.5	97.5
71	HGE	SDP	400	1B7	40	38	36	2	2	4	90.0	10.0	95.0
72	HGE	SDP	400	1B11	40	38	30	8	2	10	75.0	25.0	95.0
73	HIC	FDP	0	1A2	40	34	26	8	6	14	65.0	35.0	85.0
74	HIC	FDP	0	1A5	40	34	34	0	6	6	85.0	15.0	85.0
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	HIC	FDP	0	1B2	40	38	29	9	2	11	72.5	27.5	95.0
76	HIC	FDP	0	1B12	40	35	26	9	5	14	65.0	35.0	87.5
77	HIC	FDP	50	1A4	40	37	31	6	3	9	77.5	22.5	92.5
78	HIC	FDP	50	1A7	40	39	28	11	1	12	70.0	30.0	97.5
79	HIC	FDP	50	1B9	40	28	14	14	12	26	35.0	65.0	70.0
80	HIC	FDP	50	1B11	40	38	31	7	2	9	77.5	22.5	95.0
81	HIC	FDP	100	1A6	40	38	21	17	2	19	52.5	47.5	95.0
82	HIC	FDP	100	1A9	40	37	33	4	3	7	82.5	17.5	92.5
83	HIC	FDP	100	1B3	40	31	22	9	9	18	55.0	45.0	77.5
84	HIC	FDP	100	1B10	40	38	32	6	2	8	80.0	20.0	95.0
85	HIC	FDP	200	1A1	40	34	27	7	6	13	67.5	32.5	85.0
86	HIC	FDP	200	1A11	40	38	28	10	2	12	70.0	30.0	95.0
87	HIC	FDP	200	1B5	40	35	8	27	5	32	20.0	80.0	87.5
88	HIC	FDP	200	1B8	40	38	21	17	2	19	52.5	47.5	95.0
89	HIC	FDP	300	1A3	40	40	20	20	0	20	50.0	50.0	100.0
90	HIC	FDP	300	1A12	40	38	12	26	2	28	30.0	70.0	95.0
91	HIC	FDP	300	1B1	40	33	9	24	7	31	22.5	77.5	82.5
92	HIC	FDP	300	1B4	40	40	20	20	0	20	50.0	50.0	100.0
93	HIC	FDP	400	1A8	40	35	17	18	5	23	42.5	57.5	87.5
94	HIC	FDP	400	1A10	40	37	20	17	3	20	50.0	50.0	92.5
95	HIC	FDP	400	1B6	40	37	28	9	3	12	70.0	30.0	92.5
96	HIC	FDP	400	1B7	40	32	20	12	8	20	50.0	50.0	80.0
97	MUC	FDP	0	2A4	40	38	34	4	2	6	85.0	15.0	95.0
98	MUC	FDP	0	2A11	40	39	36	3	1	4	90.0	10.0	97.5
99	MUC	FDP	0	2B7	40	36	28	8	4	12	70.0	30.0	90.0
100	MUC	FDP	0	2B10	40	30	28	2	10	12	70.0	30.0	75.0
101	MUC	FDP	50	2A3	40	38	32	6	2	8	80.0	20.0	95.0
102	MUC	FDP	50	2B5	40	39	28	11	1	12	70.0	30.0	97.5
103	MUC	FDP	50	2B9	40	38	34	4	2	6	85.0	15.0	95.0
104	MUC	FDP	50	2A10	40	35	31	4	5	9	77.5	22.5	87.5
105	MUC	FDP	100	2B8	40	32	26	6	8	14	65.0	35.0	80.0
106	MUC	FDP	100	2B3	40	39	34	5	1	6	85.0	15.0	97.5
107	MUC	FDP	100	2A6	40	33	26	7	7	14	65.0	35.0	82.5
108	MUC	FDP	100	2A7	40	40	34	6	0	6	85.0	15.0	100.0
109	MUC	FDP	200	2A1	40	39	31	8	1	9	77.5	22.5	97.5
110	MUC	FDP	200	2A5	40	38	32	6	2	8	80.0	20.0	95.0
111	MUC	FDP	200	2B11	40	39	24	15	1	16	60.0	40.0	97.5
112	MUC	FDP	200	2B12	40	35	25	10	5	15	62.5	37.5	87.5
113	MUC	FDP	300	2B2	40	38	29	9	2	11	72.5	27.5	95.0
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	MUC	FDP	300	2B4	40	37	29	8	3	11	72.5	27.5	92.5
115	MUC	FDP	300	2A2	40	38	25	13	2	15	62.5	37.5	95.0
116	MUC	FDP	300	2A9	40	37	35	2	3	5	87.5	12.5	92.5
117	MUC	FDP	400	2A8	40	39	34	5	1	6	85.0	15.0	97.5
118	MUC	FDP	400	2A12	40	38	31	7	2	9	77.5	22.5	95.0
119	MUC	FDP	400	2B1	40	37	33	4	3	7	82.5	17.5	92.5
120	MUC	FDP	400	2B6	40	37	33	4	3	7	82.5	17.5	92.5
121	PPB	SDP	0	1A1	40	36	32	4	4	8	80.0	20.0	90.0
122	PPB	SDP	0	1A3	40	34	23	11	6	17	57.5	42.5	85.0
123	PPB	SDP	0	1B9	40	39	29	10	1	11	72.5	27.5	97.5
124	PPB	SDP	0	1B10	40	37	26	11	3	14	65.0	35.0	92.5
125	PPB	SDP	50	1A8	40	35	6	29	5	34	15.0	85.0	87.5
126	PPB	SDP	50	1A10	40	38	10	28	2	30	25.0	75.0	95.0
127	PPB	SDP	50	1B3	40	38	4	34	2	36	10.0	90.0	95.0
128	PPB	SDP	50	1B8	40	34	3	31	6	37	7.5	92.5	85.0
129	PPB	SDP	100	1A6	40	38	11	27	2	29	27.5	72.5	95.0
130	PPB	SDP	100	1A7	40	38	7	31	2	33	17.5	82.5	95.0
131	PPB	SDP	100	1B5	40	32	10	22	8	30	25.0	75.0	80.0
132	PPB	SDP	100	1B7	40	38	2	36	2	38	5.0	95.0	95.0
133	PPB	SDP	200	1A5	40	36	6	30	4	34	15.0	85.0	90.0
134	PPB	SDP	200	1A11	40	36	9	27	4	31	22.5	77.5	90.0
135	PPB	SDP	200	1B6	40	36	5	31	4	35	12.5	87.5	90.0
136	PPB	SDP	200	1B12	40	39	23	16	1	17	57.5	42.5	97.5
137	PPB	SDP	300	1A9	40	34	10	24	6	30	25.0	75.0	85.0
138	PPB	SDP	300	1A12	40	38	14	24	2	26	35.0	65.0	95.0
139	PPB	SDP	300	1B2	40	33	5	28	7	35	12.5	87.5	82.5
140	PPB	SDP	300	1B11	40	39	1	38	1	39	2.5	97.5	97.5
141	PPB	SDP	400	1A2	40	34	21	13	6	19	52.5	47.5	85.0
142	PPB	SDP	400	1A4	40	37	6	31	3	34	15.0	85.0	92.5
143	PPB	SDP	400	1B1	40	37	24	13	3	16	60.0	40.0	92.5
144	PPB	SDP	400	1B4	40	36	14	22	4	26	35.0	65.0	90.0
145	WAS	FDP	0	2A9	40	39	37	2	1	3	92.5	7.5	97.5
146	WAS	FDP	0	2A11	40	39	35	4	1	5	87.5	12.5	97.5
147	WAS	FDP	0	2B1	40	38	37	1	2	3	92.5	7.5	95.0
148	WAS	FDP	0	2B7	40	39	32	7	1	8	80.0	20.0	97.5
149	WAS	FDP	50	2A1	40	38	33	5	2	7	82.5	17.5	95.0
150	WAS	FDP	50	2A12	40	34	28	6	6	12	70.0	30.0	85.0
151	WAS	FDP	50	2B2	40	37	33	4	3	7	82.5	17.5	92.5
152	WAS	FDP	50	2B11	40	39	30	9	1	10	75.0	25.0	97.5
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	WAS	FDP	100	2A2	40	37	34	3	3	6	85.0	15.0	92.5
154	WAS	FDP	100	2A3	40	36	31	5	4	9	77.5	22.5	90.0
155	WAS	FDP	100	2B9	40	39	36	3	1	4	90.0	10.0	97.5
156	WAS	FDP	100	2B12	40	39	37	2	1	3	92.5	7.5	97.5
157	WAS	FDP	200	2A6	40	37	27	10	3	13	67.5	32.5	92.5
158	WAS	FDP	200	2A10	40	36	31	5	4	9	77.5	22.5	90.0
159	WAS	FDP	200	2B3	40	40	35	5	0	5	87.5	12.5	100.0
160	WAS	FDP	200	2B10	40	41	35	6	-1	5	87.5	12.5	102.5
161	WAS	FDP	300	2A4	40	38	17	21	2	23	42.5	57.5	95.0
162	WAS	FDP	300	2A8	40	39	17	22	1	23	42.5	57.5	97.5
163	WAS	FDP	300	2B4	40	38	26	12	2	14	65.0	35.0	95.0
164	WAS	FDP	300	2B6	40	39	17	22	1	23	42.5	57.5	97.5
165	WAS	FDP	400	2A5	40	38	26	12	2	14	65.0	35.0	95.0
166	WAS	FDP	400	2A7	40	40	34	6	0	6	85.0	15.0	100.0
167	WAS	FDP	400	2B5	40	35	28	7	5	12	70.0	30.0	87.5
168	WAS	FDP	400	2B8	40	38	34	4	2	6	85.0	15.0	95.0

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

KW 27FEB15

Juvenile Mussel Recovery
Study Number AEH-11-PSEUDO-02
Percent recovery for each species

AEH-11-PSEUDO-02

The MEANS Procedure

form=FDP

sps	N Obs	Variable	Label	N	Mean	Std Dev	Minimum	Maximum
HIC	24	rec	rec	24	36.0000000	2.9635466	28.0000000	40.0000000
		pctrec		24	90.0000000	7.4088666	70.0000000	100.0000000
MUC	24	rec	rec	24	37.0416667	2.4579802	30.0000000	40.0000000
		pctrec		24	92.6041667	6.1449505	75.0000000	100.0000000
WAS	24	rec	rec	24	38.0416667	1.6279933	34.0000000	41.0000000
		pctrec		24	95.1041667	4.0699834	85.0000000	102 5000000

form=SDP

sps	N Obs	Variable	Label	N	Mean	Std Dev	Minimum	Maximum
BLS	24	rec	rec	24	37.3750000	·.6891598	34.0000000	40.0000000
		pctrec		24	93.4375000	4.2228995	85.0000000	100.0000000
FAM	24	rec	rec	24	36.9166667	1.4421200	34.0000000	40.0000000
		pctrec		24	92.2916667	3.6053000	85.0000000	100.0000000
HGE	24	rec	rec	24	36.1250000	3.2745727	28.0000000	40.0000000
		pctrec		24	90.3125000	8.1864316	70.0000000	100.0000000
PPB	24	rec	rec	24	36.3333333	2.0144406	32.0000000	39.0000000
		pctrec		24	90.8333333	5.0361016	80.0000000	97.5000000

Performed by K Weber using SAS version 9.4 at 13:36 on 27FEB15 KW 27FEB15

Juvenile Mussel Recovery
Study Number AEH-11-PSEUDO-02
Percent recovery for each species by treatment group

AEH-11-PSEUDO-02

The MEANS Procedure

form=FDP

sps	conc	N Obs	Variable	Label	N	Mean	Std Dev	Minimum	Maximum
HIC	0	4	rec	rec	4	35.2500000	1.8929694	34.0000000	38.0000000
			pctrec		4	88.1250000	4.7324236	85.0000000	95.0000000
	50	4	rec	rec	4	35.5000000	5.0662281	28.0000000	39.0000000
			pctrec		4	88.7500000	12.6655701	70.0000000	97.5000000
	100	4	rec	rec	4	36.0000000	3.3665016	31.0000000	38.0000000
			pctrec		4	90.0000000	8.4162541	77.5000000	95.0000000
	200	4	rec	rec	4	36.2500000	2.0615528	34.0000000	38.0000000
			pctrec		4	90.6250000	5.1538820	85.0000000	95.0000000
	300	4	rec	rec	4	37.7500000	3.3040379	33.0000000	40.0000000
			pctrec		4	94.3750000	8.2600948	82.5000000	100.0000000
	400	4	rec	rec	4	35.2500000	2.3629078	32.0000000	37.0000000
			pctrec		4	88.1250000	5.9072695	80.0000000	92.5000000
MUC	0	4	rec	rec	4	35.7500000	4.0311289	30.0000000	39.0000000
			pctrec		4	89.3750000	10.0778222	75.0000000	97.5000000
	50	4	rec	rec	4	37.5000000	1.7320508	35.0000000	39.0000000
			pctrec		4	93.7500000	4.3301270	87.5000000	97.5000000
	100	4	rec	rec	4	36.0000000	4.0824829	32.0000000	40.0000000
			pctrec		4	90.0000000	10.2062073	80.0000000	100.0000000
	200	4	rec	rec	4	37.7500000	1.8929694	35.0000000	39.0000000
			pctrec		4	94.3750000	4.7324236	87.5000000	97.5000000
	300	4	rec	rec	4	37.5000000	0.5773503	37.0000000	38.0000000
			pctrec		4	93.7500000	1.4433757	92.5000000	95.0000000
	400	4	rec	rec	4	37.7500000	0.9574271	37.0000000	39.0000000
			pctrec		4	94.3750000	2.3935678	92.5000000	97.5000000
WAS	0	4	rec	rec	4	38.7500000	0.5000000	38.0000000	39.0000000
			pctrec		4	96.8750000	1.2500000	95.0000000	97.5000000
	50	4	rec	rec	4	37.0000000	2.1602469	34.0000000	39.0000000
			pctrec		4	92.5000000	5.4006172	85.0000000	97.5000000
	100	4	rec	rec	4	37.7500000	1.5000000	36.0000000	39.0000000
			pctrec		4	94.3750000	3.7500000	90.0000000	97.5000000
	200	4	rec	rec	4	38.5000000	2.3804761	36.0000000	41.0000000
			pctrec		4	96.2500000	5.9511904	90.0000000	102.5000000
	300	4	rec	rec	4	38.5000000	0.5773503	38.0000000	39.0000000
			pctrec		4	96.2500000	1.4433757	95.0000000	97.5000000
	400	4	rec	rec	4	37.7500000	2.0615528	35.0000000	40.0000000
			pctrec		4	94.3750000	5.1538820	87.5000000	100.0000000

form=SDP

sps	conc	N Obs	Variable	Label	N	Mean	Std Dev	Minimum	Maximum

AEH-11-PSEUDO-02

BLS	0	4	rec	rec	4	37.2500000	2.2173558	35.0000000	40.0000000
			pctrec		4	93.1250000	5.5433895	87.5000000	100.0000000
	50	4	rec	rec	4	37.2500000	0.9574271	36.0000000	38.0000000
			pctrec		4	93.1250000	2.3935678	90.0000000	95.0000000
	100	4	rec	rec	4	37.0000000	2.1602469	34.0000000	39.0000000
			pctrec		4	92.5000000	5.4006172	85.0000000	97.5000000
	200	4	rec	rec	4	37.5000000	2.3804761	35.0000000	40.0000000
			pctrec		4	93.7500000	5.9511904	87.5000000	100.0000000
	300	4	rec	rec	4	37.2500000	2.2173558	35.0000000	40.0000000
			pctrec		4	93.1250000	5.5433895	87.5000000	100.0000000
	400	4	rec	rec	4	38.0000000	0	38.0000000	38.0000000
			pctrec		4	95.0000000	0	95.0000000	95.0000000
FAM	0	4	rec	rec	4	36.5000000	1.0000000	35.0000000	37.0000000
			pctrec		4	91.2500000	2.5000000	87.5000000	92.5000000
	50	4	rec	rec	4	36.5000000	2.0816660	34.0000000	39.0000000
			pctrec		4	91.2500000	5.2041650	85.0000000	97.5000000
	100	4	rec	rec	4	38.5000000	1.2909944	37.0000000	40.0000000
			pctrec		4	96.2500000	3.2274861	92.5000000	100.0000000
	200	4	rec	rec	4	36.7500000	0.9574271	36.0000000	38.0000000
			pctrec		4	91.8750000	2.3935678	90.0000000	95.0000000
	300	4	rec	rec	4	36.7500000	0.9574271	36.0000000	38.0000000
			pctrec		4	91.8750000	2.3935678	90.0000000	95.0000000
	400	4	rec	rec	4	36.5000000	1.7320508	35.0000000	38.0000000
			pctrec		4	91.2500000	4.3301270	87.5000000	95.0000000
HGE	0	4	rec	rec	4	37.2500000	2.2173558	35.0000000	40.0000000
			pctrec		4	93.1250000	5.5433895	87.5000000	100.0000000
	50	4	rec	rec	4	35.2500000	3.5000000	30.0000000	37.0000000
			pctrec		4	88.1250000	8.7500000	75.0000000	92.5000000
	100	4	rec	rec	4	37.0000000	2.5819889	34.0000000	40.0000000
			pctrec		4	92.5000000	6.4549722	85.0000000	100.0000000
	200	4	rec	rec	4	34.5000000	5.5075705	28.0000000	40.0000000
			pctrec		4	86.2500000	13.7689264	70.0000000	100.0000000
	300	4	rec	rec	4	35.0000000	3.7416574	30.0000000	39.0000000
			pctrec		4	87.5000000	9.3541435	75.0000000	97.5000000
	400	4	rec	rec	4	37.7500000	1.2583057	36.0000000	39.0000000
			pctrec		4	94.3750000	3.1457643	90.0000000	97.5000000
PPB	0	4	rec	rec	4	36.5000000	2.0816660	34.0000000	39.0000000
			pctrec		4	91.2500000	5.2041650	85.0000000	97.5000000
	50	4	rec	rec	4	36.2500000	2.0615528	34.0000000	38.0000000
			pctrec		4	90.6250000	5.1538820	85.0000000	95.0000000
	100	4	rec	rec	4	36.5000000	3.0000000	32.0000000	38.0000000
			pctrec		4	91.2500000	7.5000000	80.0000000	95.0000000
	200	4	rec	rec	4	36.7500000	1.5000000	36.0000000	39.0000000
			pctrec		4	91.8750000	3.7500000	90.0000000	97.5000000
	300	4	rec	rec	4	36.0000000	2.9439203	33.0000000	39.0000000
			pctrec		4	90.0000000	7.3598007	82.5000000	97.5000000
	400	4	rec	rec	4	36.0000000	1.4142136	34.0000000	37.0000000

			pctrec		4	90.0000000	3.5355339	85.0000000	92.5000000

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

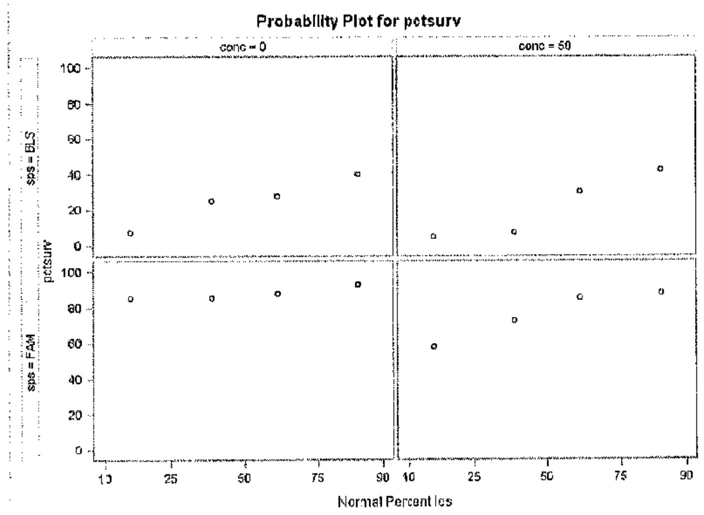
KW 27FEB15

AEH-11-PSEUDO-02

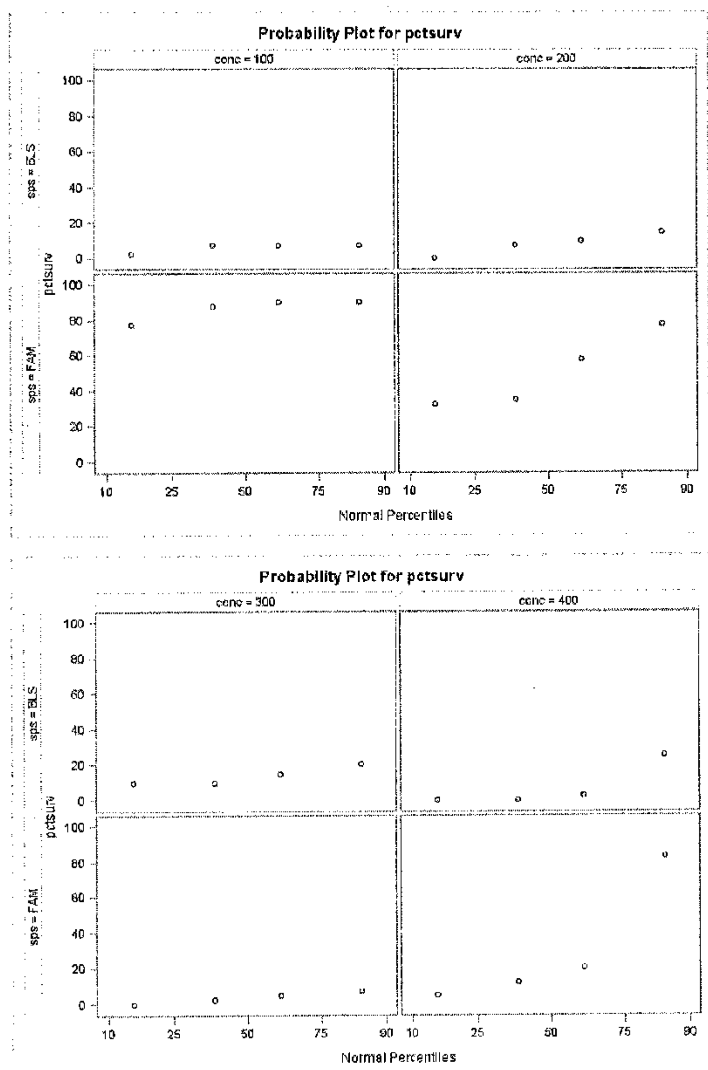
Juvenile Mussel Survival
Study Number AEH-11-PSEUDO-02

The UNIVARIATE Procedure

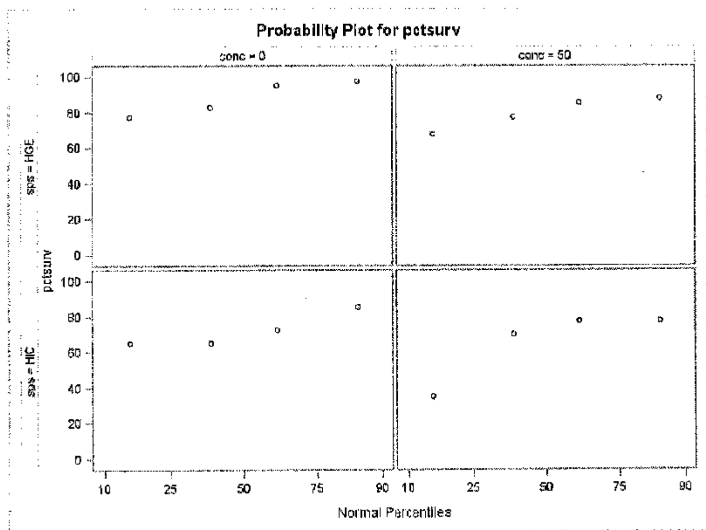
AEH-11-PSEUDO-02

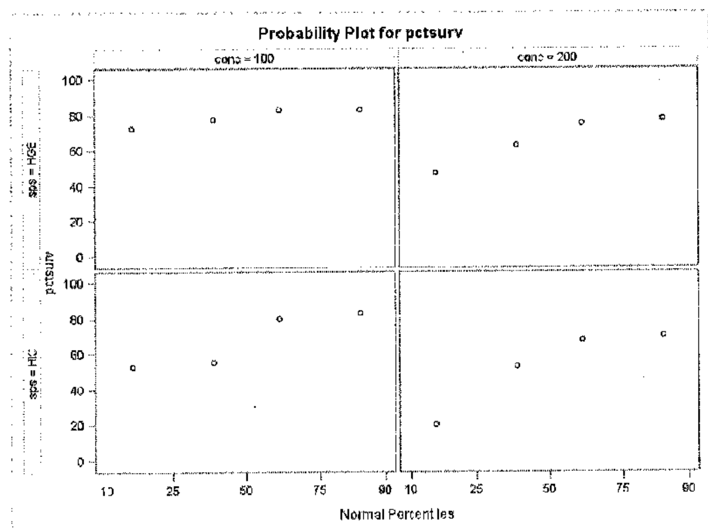


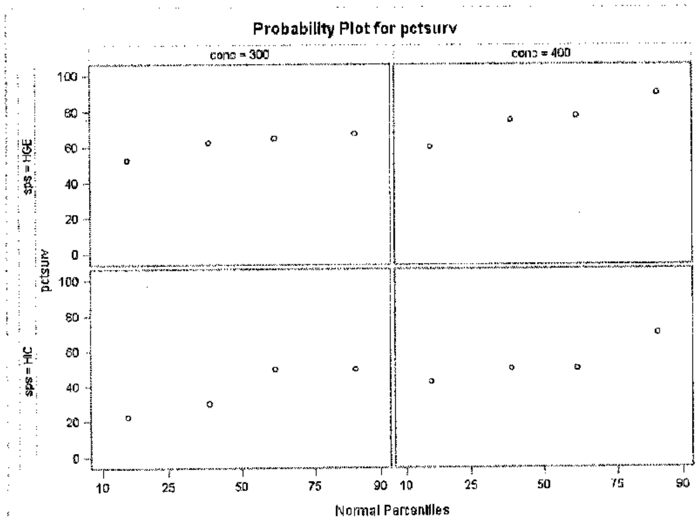
AEH-11-PSEUDO-02



AEH-11-PSEUDO-02







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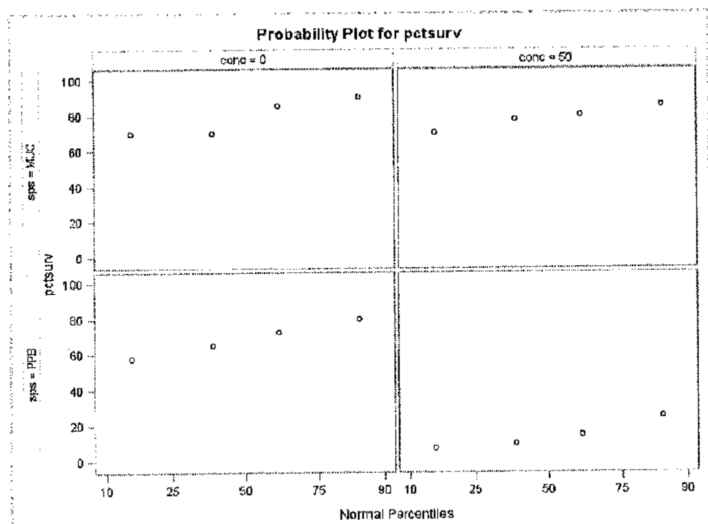
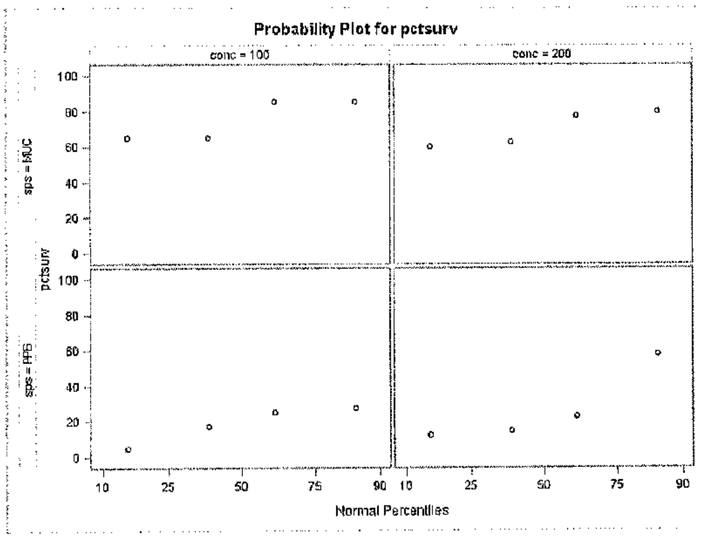
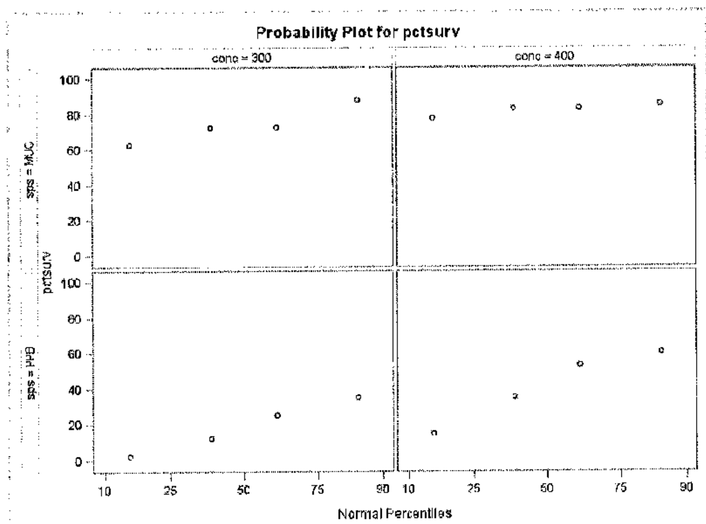
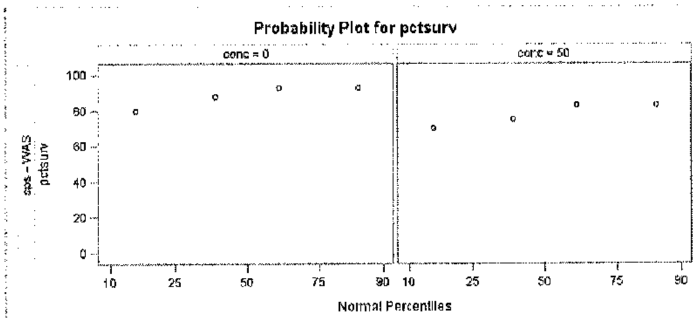


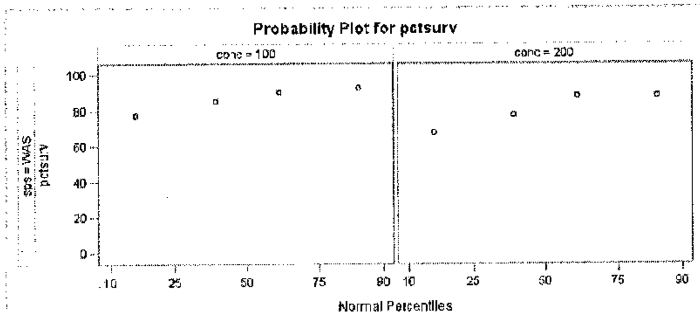
AEH-11-PSEUDO-02

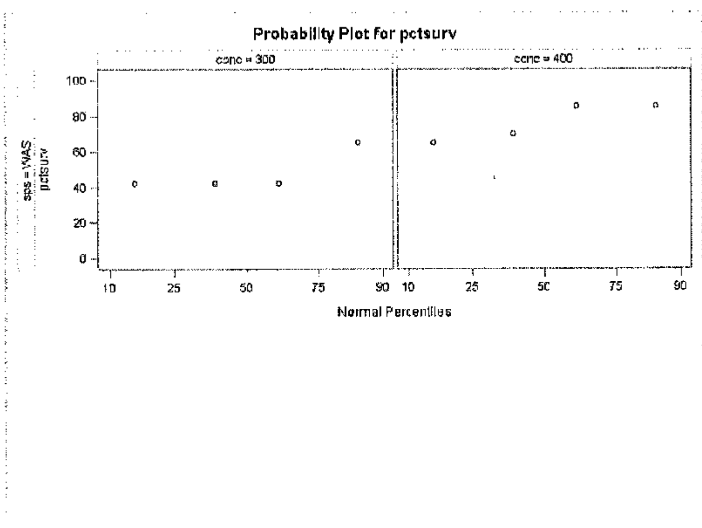




AEH-11-PSEUDO-02







AEH-11-PSEUDO-02

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

KW 27FEB15

Juvenile Mussel Survival
Study Number AEH-11-PSEUDO-02
Mean survival for each species

AEH-11-PSEUDO-02

The MEANS Procedure

sps=BLS form=SDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	25.0000000	13.3853153	7.5000000	40.0000000
50	4	4	21.2500000	18.0854453	5.0000000	42.5000000
100	4	4	6.2500000	2.5000000	2.5000000	7.5000000
200	4	4	8.1250000	5.2500000	0	15.0000000
300	4	4	13.7500000	4.7871355	10.0000000	20.0000000
400	4	4	6.8750000	12.1406686	0	25.0000000

sps=FAM form=SDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	87.5000000	3.5355339	85.0000000	92.5000000
50	4	4	75.6250000	13.7500000	57.5000000	87.5000000
100	4	4	85.2500000	5.9511904	77.5000000	90.0000000
200	4	4	50.6250000	21.1517336	32.5000000	77.5000000
300	4	4	3.7500000	3.2274861	0	7.5000000
400	4	4	30.0000000	35.5316760	5.0000000	82.5000000

sps=HGE form=SDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	88.1250000	9.6555252	77.5000000	97.5000000
50	4	4	79.3750000	8.9849411	67.5000000	87.5000000
100	4	4	78.7500000	4.7871355	72.5000000	82.5000000
200	4	4	65.6250000	13.7500000	47.5000000	77.5000000
300	4	4	61.8750000	6.5748891	52.5000000	67.5000000
400	4	4	75.6250000	12.3110723	60.0000000	90.0000000

sps=HIC form=FDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	71.8750000	9.4372930	65.0000000	85.0000000
50	4	4	65.0000000	20.3100960	35.0000000	77.5000000

AEH-11-PSEUDO-02

100	4	4	67.5000000	15.9426054	52.5000000	82.5000000
200	4	4	52.5000000	23.0036229	20.0000000	70.0000000
300	4	4	38.1250000	14.0497628	22.5000000	50.0000000
400	4	4	53.1250000	11.7924764	42.5000000	70.0000000

sps=MUC form=FDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	78.7500000	10.3077641	70.0000000	90.0000000
50	4	4	78.1250000	6.2500000	70.0000000	85.0000000
100	4	4	75.0000000	11.5470054	65.0000000	85.0000000
200	4	4	70.0000000	10.2062073	60.0000000	80.0000000
300	4	4	73.7500000	10.3077641	62.5000000	87.5000000
400	4	4	81.8750000	3.1457643	77.5000000	85.0000000

sps=PPB form=SDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	68.7500000	9.6824584	57.5000000	80.0000000
50	4	4	14.3750000	7.7392398	7.5000000	25.0000000
100	4	4	18.7500000	10.1036297	5.0000000	27.5000000
200	4	4	26.8750000	20.8541563	12.5000000	57.5000000
300	4	4	18.7500000	14.2156018	2.5000000	35.0000000
400	4	4	40.6250000	20.0390244	15.0000000	60.0000000

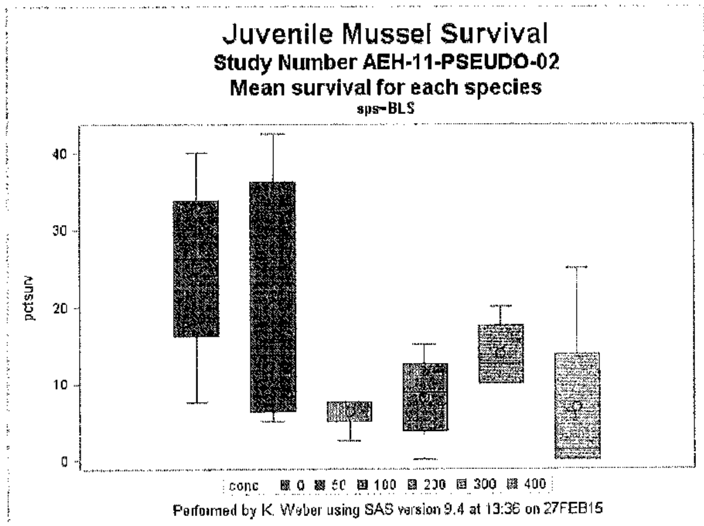
sps=WAS form=FDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	4	4	88.1250000	5.9072695	80.0000000	92.5000000
50	4	4	77.5000000	6.1237244	70.0000000	82.5000000
100	4	4	86.2500000	6.6143783	77.5000000	92.5000000
200	4	4	80.0000000	9.5742711	67.5000000	87.5000000
300	4	4	48.1250000	11.2500000	42.5000000	65.0000000
400	4	4	76.2500000	10.3077641	65.0000000	85.0000000

Perfomed by K Weber using SAS version 9.4 at 13:36 on 27FEB15

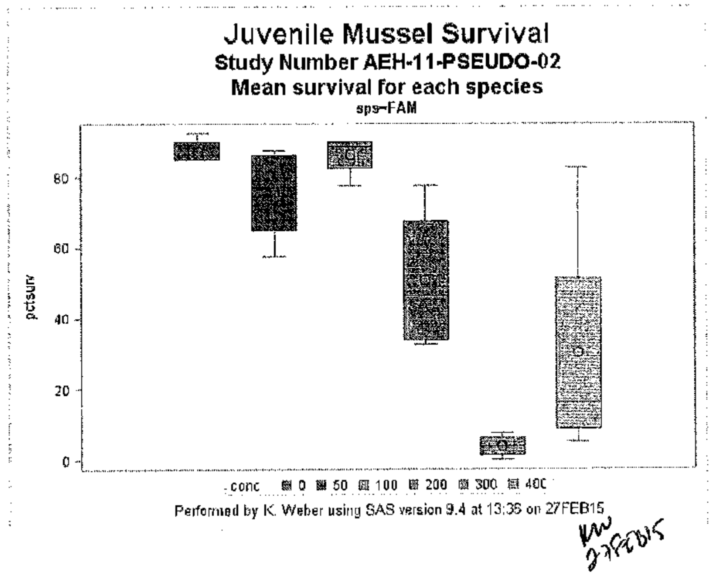
kw 27FEB15

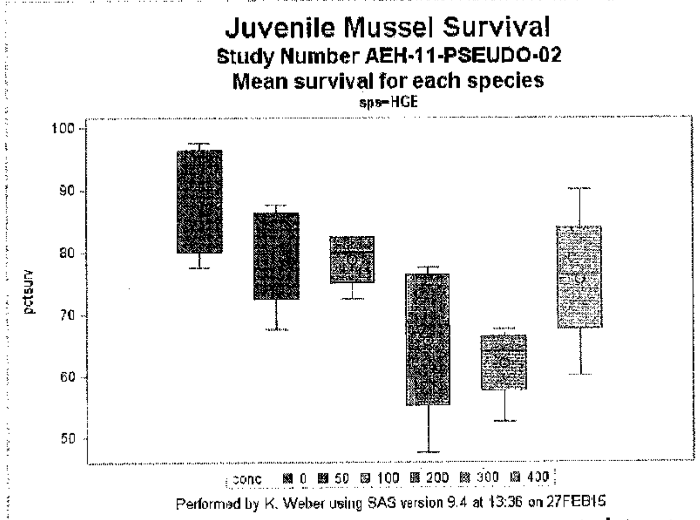
AEH-11-PSEUDO-02



KW 27FEB15

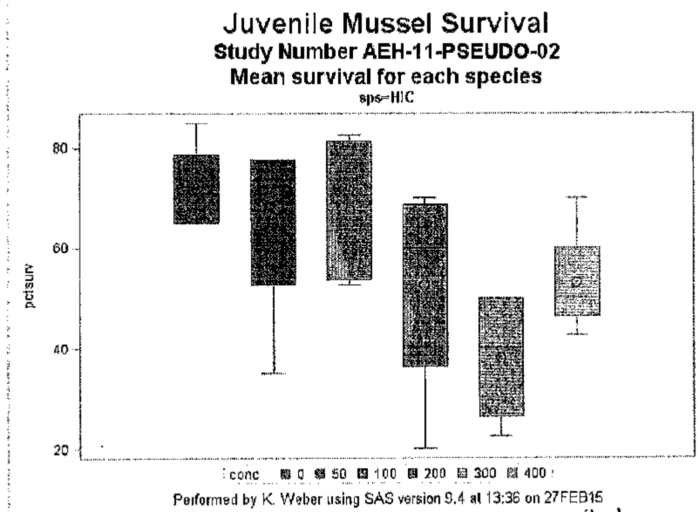
AEH-11-PSEUDO-02





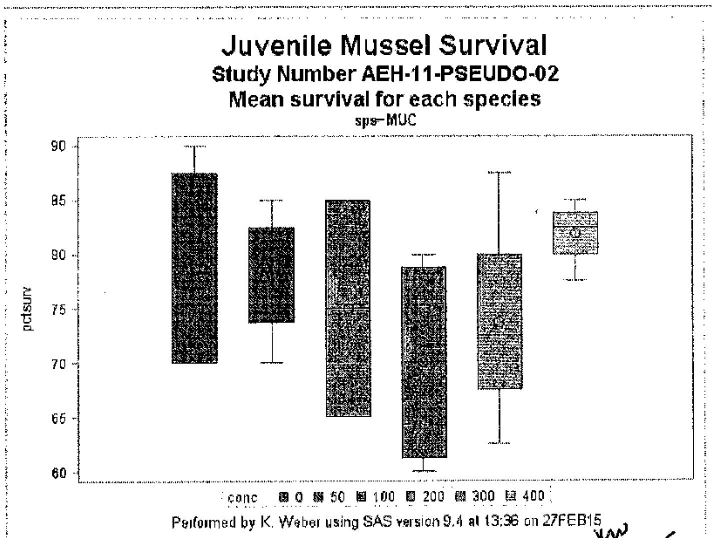
AEH-11-PSEUDO-02

KW 27FEB15



AEH-11-PSEUDO-02

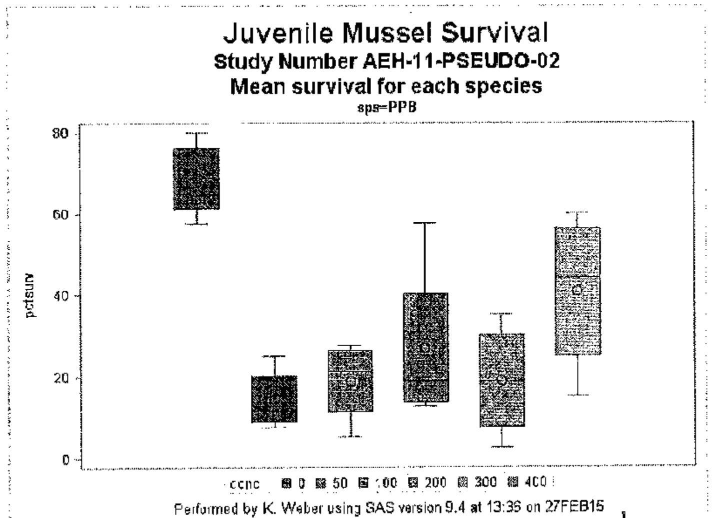
KW 27FEB15



KW 27FEB15

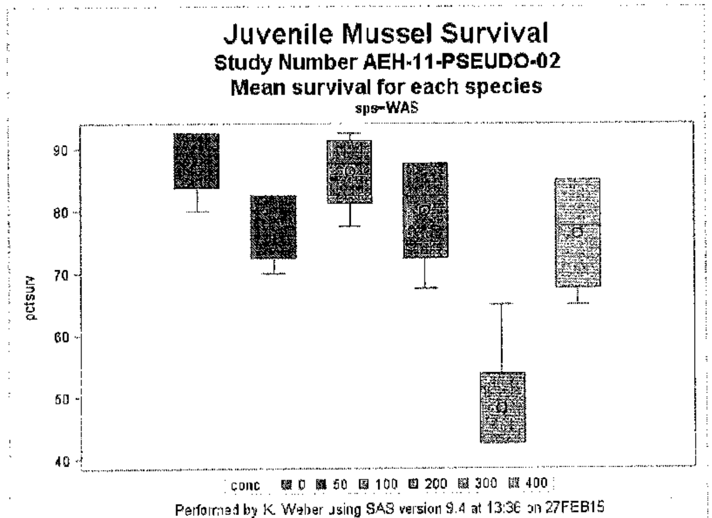
AEH-11-PSEUDO-02

AEH-11-PSEUDO-02



KW 27FEB15

AEH-11-PSEUDO-02



KW 27FEB15

Juvenile Mussel Survival
Study Number AEH-11-PSEUDO-02
Mean survival for each formulation

AEH-11-PSEUDO-02

The MEANS Procedure

form=FDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	12	12	79.5833333	10.5439197	65.0000000	92.5000000
50	12	12	73.5416667	13.1623746	35.0000000	85.0000000
100	12	12	76.2500000	13.5050496	52.5000000	92.5000000
200	12	12	67.5000000	18.4020750	20.0000000	87.5000000
300	12	12	53.3333333	19.0493776	22.5000000	87.5000000
400	12	12	70.4166667	15.4417282	42.5000000	85.0000000

form=SDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	16	16	67.3437500	27.8906907	7.5000000	97.5000000
50	16	16	47.6562500	33.0084427	5.0000000	87.5000000
100	16	16	47.5000000	36.9909899	2.5000000	90.0000000
200	16	16	37.8125000	27.1857040	0	77.5000000
300	16	16	24.5312500	24.1388130	0	67.5000000
400	16	16	38.2812500	32.3614837	0	90.0000000

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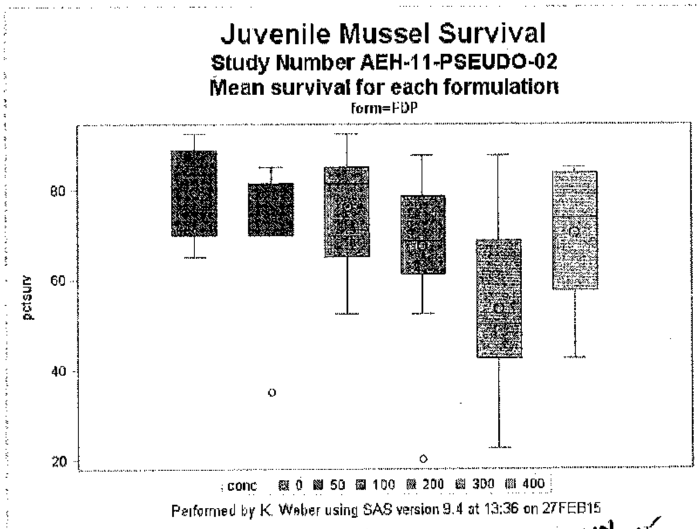
KW 27FEB15

AEH-11-PSEUDO-02



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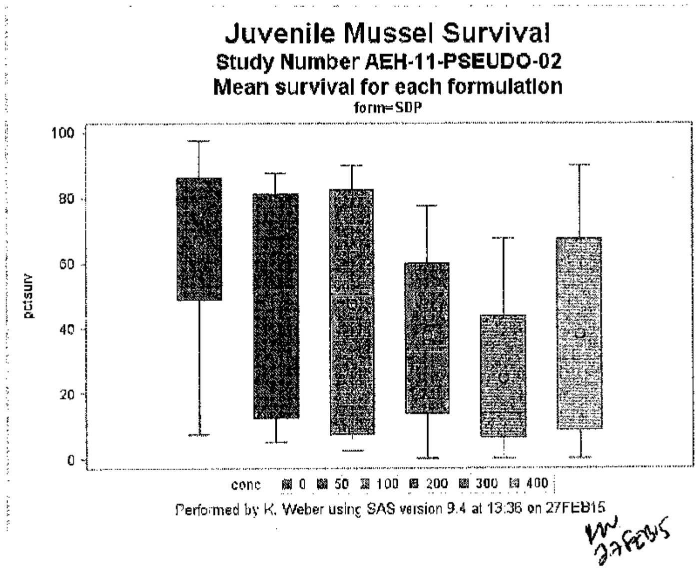


AEH-11-PSEUDO-02

Juvenile Mussel Survival
Study Number AEH-11-PSEUDO-02
Mean survival for each formulation without BLS

AEH-11-PSEUDO-02

The MEANS Procedure

form=FDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	12	12	79.5833333	10.5439197	65.0000000	92.5000000
50	12	12	73.5416667	13.1623746	35.0000000	85.0000000
100	12	12	76.2500000	13.5050496	52.5000000	92.5000000
200	12	12	67.5000000	18.4020750	20.0000000	87.5000000
300	12	12	53.3333333	19.0493776	22.5000000	87.5000000
400	12	12	70.4166667	15.4417282	42.5000000	85.0000000

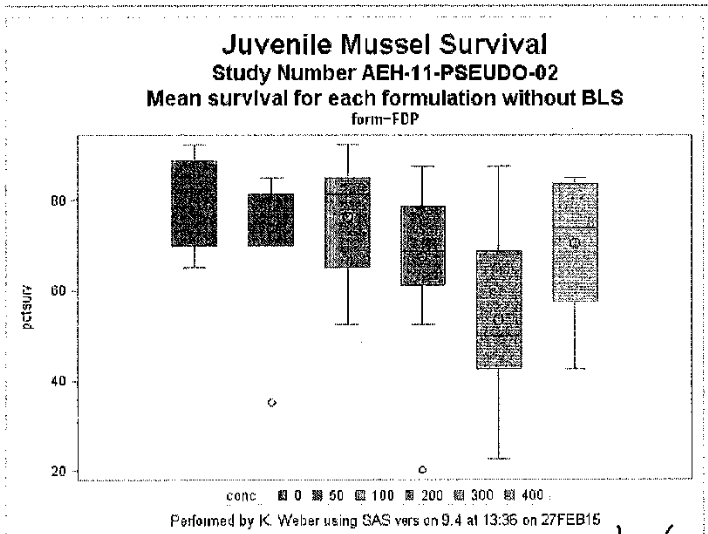
form=SDP

Analysis Variable : pctsurv						
conc	N Obs	N	Mean	Std Dev	Minimum	Maximum
0	12	12	81.4583333	11.9401126	57.5000000	97.5000000
50	12	12	56.4583333	32.5342186	7.5000000	87.5000000
100	12	12	61.2500000	32.2366958	5.0000000	90.0000000
200	12	12	47.7083333	23.8713011	12.5000000	77.5000000
300	12	12	28.1250000	27.0547635	0	67.5000000
400	12	12	48.7500000	30.1605552	5.0000000	90.0000000

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

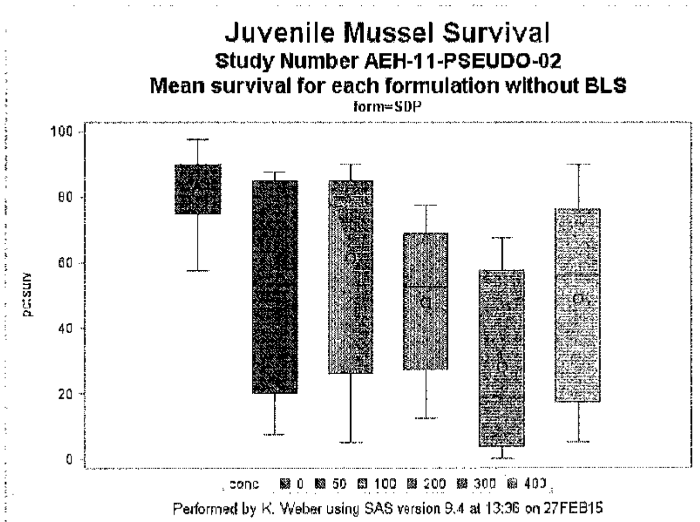
KW 27FEB15

AEH-11-PSEUDO-02



kw 27FEB15

AEH-11-PSEUDO-02



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Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

AEH-11-PSEUDO-02

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=FDP sps=HIC

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Maximum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	403
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

AEH-11-PSEUDO-02

Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	90.313308939	.	1.407314
1	0	3	90.077830398	0.23547854	0.016389
2	0	3	90.077814434	0.00001593	2.442E-6

Convergence criterion (ABSGCONV=0.00001) satisfied.

Fit Statistics	
-2 Log Likelihood	180.16
AIC (smaller is better)	192.16
AICC (smaller is better)	197.10
BIC (smaller is better)	199.22
CAIC (smaller is better)	205.22
HQIC (smaller is better)	194.03
Pearson Chi-Square	83.15
Pearson Chi-Square / DF	4.62

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	-0.9383	0.3779	18	-2.48	0.0231
conc	50	-0.6190	0.3563	18	-1.74	0.0994
conc	100	-0.7309	0.3628	18	-2.01	0.0591
conc	200	-0.1001	0.3403	18	-0.29	0.7720
conc	300	0.4842	0.3499	18	1.38	0.1832
conc	400	-0.1252	0.3405	18	-0.37	0.7175
Resi		4.6197	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	2.56	0.0567

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	0.443	18	0.152	1.291
50	400	0.610	18	0.217	1.719
100	400	0.546	18	0.192	1.552
200	400	1.025	18	0.373	2.819
300	400	1.839	18	0.660	5.130

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conc Least Squares Means

conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	-0.9383	0.3779	18	-2.48	0.0231	0.05	-1.7323	-0.1443	0.2813	0.07640	0.1503	0.4640
50	-0.6190	0.3563	18	-1.74	0.0994	0.05	-1.3675	0.1294	0.3500	0.08105	0.2030	0.5323
100	-0.7309	0.3628	18	-2.01	0.0591	0.05	-1.4931	0.0330	0.3250	0.07959	0.1835	0.5078
200	-0.1001	0.3403	18	-0.29	0.7720	0.05	-0.8150	0.6148	0.4750	0.08485	0.3068	0.6490
300	0.4842	0.3499	18	1.38	0.1832	0.05	-0.2508	1.2193	0.6187	0.08253	0.4376	0.7719
400	-0.1252	0.3405	18	-0.37	0.7175	0.05	-0.8405	0.5902	0.4688	0.08479	0.3014	0.6434

Differences of conc Least Squares Means

conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	0.3192	0.5194	18	0.61	0.5465	0.05	-0.7719	1.4104	1.376	0.462	4.098
100	0	0.2074	0.5239	18	0.40	0.6969	0.05	-0.8932	1.3080	1.230	0.409	3.699
200	0	0.8382	0.5085	18	1.65	0.1167	0.05	-0.2302	1.9066	2.312	0.794	6.730
300	0	1.4225	0.5150	18	2.76	0.0128	0.05	0.3405	2.5045	4.148	1.406	12.237
400	0	0.8131	0.5087	18	1.60	0.1274	0.05	-0.2556	1.8818	2.255	0.774	6.566

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Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

AEH-11-PSEUDO-02

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=FDP sps=MUC

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Maximum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	228
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

AEH-11-PSEUDO-02

Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	62.005671026		1.223129
1	0	3	61.764457035	0.24121399	0.026708
2	0	3	61.764383767	0.00007327	0.000014
3	0	3	61.764383767	0.00000000	3.82E-12

Convergence criterion (GCONV=1E-8) satisfied.

Fit Statistics	
-2 Log Likelihood	123.53
AIC (smaller is better)	135.53
AICC (smaller is better)	140.47
BIC (smaller is better)	142.60
CAIC (smaller is better)	148.60
HQIC (smaller is better)	137.40
Pearson Chi-Square	32.23
Pearson Chi-Square / DF	1.79

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	-1.3099	0.2586	18	-5.07	<.0001
conc	50	-1.2730	0.2559	18	-4.97	<.0001
conc	100	-1.0986	0.2443	18	-4.50	0.0003
conc	200	-0.8473	0.2309	18	-3.67	0.0018
conc	300	-1.0330	0.2404	18	-4.30	0.0004
conc	400	-1.5079	0.2746	18	-5.49	<.0001
Resi		1.7908	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	22.12	<.0001

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	1.219	18	0.552	2.693
50	400	1.265	18	0.575	2.783
100	400	1.506	18	0.696	3.259
200	400	1.936	18	0.911	4.114
300	400	1.608	18	0.747	3.462

conc Least Squares Means												
conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	-1.3099	0.2586	18	-5.07	<.0001	0.05	-1.8533	-0.7666	0.2125	0.04328	0.1355	0.3172
50	-1.2730	0.2559	18	-4.97	<.0001	0.05	-1.8106	-0.7353	0.2188	0.04373	0.1406	0.3240
100	-1.0986	0.2443	18	-4.50	0.0003	0.05	-1.6119	-0.5853	0.2500	0.04581	0.1663	0.3577
200	-0.8473	0.2309	18	-3.67	0.0018	0.05	-1.3323	-0.3623	0.3000	0.04848	0.2088	0.4104
300	-1.0330	0.2404	18	-4.30	0.0004	0.05	-1.5382	-0.5279	0.2625	0.04665	0.1768	0.3710
400	-1.5079	0.2746	18	-5.49	<.0001	0.05	-2.0849	-0.9309	0.1813	0.04075	0.1106	0.2827

Differences of conc Least Squares Means												
conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	0.03696	0.3638	18	0.10	0.9202	0.05	-0.7274	0.8013	1.036	0.483	2.229
100	0	0.2113	0.3558	18	0.59	0.5599	0.05	-0.5361	0.9588	1.235	0.585	2.608
200	0	0.4626	0.3467	18	1.33	0.1987	0.05	-0.2657	1.1909	1.588	0.767	3.290
300	0	0.2769	0.3531	18	0.78	0.4431	0.05	-0.4650	1.0188	1.319	0.628	2.770
400	0	-0.1980	0.3772	18	-0.52	0.6061	0.05	-0.9905	0.5946	0.820	0.371	1.812

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Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=FDP sps=WAS

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Max mum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	230
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

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Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	59.244589077	.	0.951763
1	0	3	59.04090318	0.20368590	0.017954
2	0	3	59.040816988	0.00008619	0.000012
3	0	3	59.040816988	0.00000000	5.57E-12

Convergence criterion (GCONV=1E-8) satisfied.

Fit Statistics	
-2 Log Likelihood	118.08
AIC (smaller is better)	130.08
AICC (smaller is better)	135.02
BIC (smaller is better)	137.15
CAIC (smaller is better)	143.15
HQIC (smaller is better)	131.96
Pearson Chi-Square	31.01
Pearson Chi-Square / DF	1.72

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	-2.0043	0.3208	18	-6.25	<.0001
conc	50	-1.2368	0.2485	18	-4.98	<.0001
conc	100	-1.8362	0.3013	18	-6.09	<.0001
conc	200	-1.3863	0.2594	18	-5.34	<.0001
conc	300	0.07504	0.2077	18	0.36	0.7221
conc	400	-1.1664	0.2438	18	-4.78	0.0001
Resi		1.7227	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	25.42	<.0001

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	0.433	18	0.186	1.009
50	400	0.932	18	0.449	1.937
100	400	0.512	18	0.227	1.156
200	400	0.803	18	0.380	1.696
300	400	3.461	18	1.766	6.783

conc Least Squares Means

conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	-2.0043	0.3208	18	-6.25	<.0001	0.05	-2.6782	-1.3304	0.1188	0.03357	0.06427	0.2091
50	-1.2368	0.2485	18	-4.98	<.0001	0.05	-1.7588	-0.7147	0.2250	0.04333	0.1469	0.3286
100	-1.8362	0.3013	18	-6.09	<.0001	0.05	-2.4692	-1.2032	0.1375	0.03573	0.07804	0.2309
200	-1.3863	0.2594	18	-5.34	<.0001	0.05	-1.9313	-0.8413	0.2000	0.04151	0.1266	0.3013
300	0.07504	0.2077	18	0.36	0.7221	0.05	-0.3613	0.5113	0.5188	0.05184	0.4107	0.6251
400	-1.1664	0.2438	18	-4.78	0.0001	0.05	-1.6787	-0.6542	0.2375	0.04416	0.1573	0.3421

Differences of conc Least Squares Means

conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	0.7676	0.4057	18	1.89	0.0747	0.05	-0.08488	1.6200	2.154	0.919	5.053
100	0	0.1681	0.4401	18	0.38	0.7069	0.05	-0.7566	1.0927	1.183	0.469	2.982
200	0	0.6180	0.4125	18	1.50	0.1514	0.05	-0.2487	1.4847	1.855	0.780	4.414
300	0	2.0794	0.3821	18	5.44	<.0001	0.05	1.2766	2.8822	7.999	3.584	17.853
400	0	0.8379	0.4029	18	2.08	0.0521	0.05	-0.00860	1.6844	2.311	0.991	5.389

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Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=SDP sps=BLS

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Maximum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	830
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	77.245561628	.	5.711995
1	0	3	72.365065097	4.88049653	1.075187
2	0	3	72.189427193	0.17563790	0.071561
3	0	3	72.188599825	0.00082737	0.000387
4	0	3	72.1885998	0.00000002	1.154E-8

Convergence criterion (GCONV=1E-8) satisfied.

Fit Statistics	
-2 Log Likelihood	144.38
AIC (smaller is better)	156.38
AICC (smaller is better)	161.32
BIC (smaller is better)	163.45
CAIC (smaller is better)	169.45
HQIC (smaller is better)	158.25
Pearson Chi-Square	72.43
Pearson Chi-Square / DF	4.02

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	1.0986	0.3662	18	3.00	0.0077
conc	50	1.3099	0.3877	18	3.38	0.0033
conc	100	2.7081	0.6551	18	4.13	0.0006
conc	200	2.4255	0.5804	18	4.18	0.0006
conc	300	1.8362	0.4605	18	3.99	0.0009
conc	400	2.6081	0.6267	18	4.16	0.0006
Resl		4.0237	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	14.69	<.0001

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	0.221	18	0.048	1.018
50	400	0.274	18	0.058	1.287
100	400	1.107	18	0.165	7.439
200	400	0.835	18	0.139	5.023

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300	400	0.463	18	0.090	2.373

conc Least Squares Means

conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	1.0986	0.3662	18	3.00	0.0077	0.05	0.3292	1.8680	0.7500	0.06867	0.5816	0.8662
50	1.3099	0.3877	18	3.38	0.0033	0.05	0.4955	2.1244	0.7875	0.06487	0.6214	0.8932
100	2.7081	0.6551	18	4.13	0.0006	0.05	1.3317	4.0844	0.9375	0.03839	0.7911	0.9834
200	2.4255	0.5804	18	4.18	0.0006	0.05	1.2061	3.6449	0.9188	0.04333	0.7696	0.9745
300	1.8362	0.4605	18	3.99	0.0009	0.05	0.8688	2.8037	0.8625	0.05461	0.7045	0.9429
400	2.6061	0.6267	18	4.16	0.0006	0.05	1.2893	3.9228	0.9312	0.04013	0.7840	0.9806

Differences of conc Least Squares Means

conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	0.2113	0.5333	18	0.40	0.6966	0.05	-0.9091	1.3317	1.235	0.403	3.788
100	0	1.6094	0.7505	18	2.14	0.0459	0.05	0.03260	3.1863	5.000	1.033	24.198
200	0	1.3269	0.6863	18	1.93	0.0691	0.05	-0.1150	2.7687	3.769	0.891	15.938
300	0	0.7376	0.5884	18	1.25	0.2260	0.05	-0.4985	1.9737	2.091	0.607	7.197
400	0	1.5074	0.7259	18	2.08	0.0524	0.05	-0.01760	3.0325	4.515	0.983	20.749

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Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=SDP sps=FAM

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Maximum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	426
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

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Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	97.634836406	.	1.460501
1	0	3	97.292908253	0.34192815	0.058074
2	0	3	97.291881474	0.00102678	0.000482
3	0	3	97.291881407	0.00000007	3.393E-8

Convergence criterion (GCONV=1E-8) satisfied.

Fit Statistics	
-2 Log Likelihood	194.58
AIC (smaller is better)	206.58
AICC (smaller is better)	211.52
BIC (smaller is better)	213.65
CAIC (smaller is better)	219.65
HQIC (smaller is better)	208.46
Pearson Chi-Square	114.35
Pearson Chi-Square / DF	6.35

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	-1.9459	0.6025	18	-3.23	0.0046
conc	50	-1.1322	0.4641	18	-2.44	0.0253
conc	100	-1.8362	0.5786	18	-3.17	0.0053
conc	200	-0.02500	0.3985	18	-0.06	0.9507
conc	300	3.2452	1.0488	18	3.09	0.0063
conc	400	0.8473	0.4348	18	1.95	0.0671
Resi		6.3526	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	6.64	0.0008

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	0.061	18	0.013	0.292
50	400	0.138	18	0.036	0.525
100	400	0.068	18	0.015	0.313
200	400	0.418	18	0.121	1.443
300	400	11.000	18	1.013	119.491

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conc Least Squares Means

conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	-1.9459	0.6025	18	-3.23	0.0046	0.05	-3.2117	-0.6801	0.1250	0.06590	0.03873	0.3362
50	-1.1322	0.4641	18	-2.44	0.0253	0.05	-2.1073	-0.1572	0.2436	0.08555	0.1084	0.4608
100	-1.8362	0.5786	18	-3.17	0.0053	0.05	-3.0518	-0.6206	0.1375	0.06862	0.04514	0.3496
200	-0.02500	0.3985	18	-0.06	0.9507	0.05	-0.8623	0.8123	0.4938	0.09962	0.2969	0.6926
300	3.2452	1.0488	18	3.09	0.0063	0.05	1.0417	5.4487	0.9625	0.03786	0.7392	0.9957
400	0.8473	0.4348	18	1.95	0.0671	0.05	-0.06622	1.7608	0.7000	0.09131	0.4835	0.8533

Differences of conc Least Squares Means

conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	0.8137	0.7605	18	1.07	0.2988	0.05	-0.7841	2.4115	2.256	0.457	11.150
100	0	0.1097	0.8353	18	0.13	0.8970	0.05	-1.6453	1.8647	1.116	0.193	6.454
200	0	1.9209	0.7224	18	2.66	0.0160	0.05	0.4032	3.4386	6.827	1.497	31.143
300	0	5.1911	1.2096	18	4.29	0.0004	0.05	2.6499	7.7323	179.667	14.153	>999.999
400	0	2.7932	0.7430	18	3.76	0.0014	0.05	1.2322	4.3542	16.333	3.429	77.807

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

KW
27FEB15

AEH-11-PSEUDO-02

Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=SDP sps=HGE

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Maximum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	Levels	Values
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	241
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

AEH-11-PSEUDO-02

Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	65.737660283	.	2.276718
1	0	3	65.11468968	0.62297060	0.165189
2	0	3	65.111946057	0.00274362	0.00111
3	0	3	65.111945935	0.00000012	5.124E-8

Convergence criterion (GCONV=1E-8) satisfied.

Fit Statistics	
-2 Log Likelihood	130 22
AIC (smaller is better)	142 22
AICC (smaller is better)	147 17
BIC (smaller is better)	149 29
CAIC (smaller is better)	155 29
HQIC (smaller is better)	144 10
Pearson Chi-Square	40 37
Pearson Chi-Square / DF	2 24

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	-2.0043	0.3660	18	-5.48	<.0001
conc	50	-1.3477	0.2926	18	-4.61	0.0002
conc	100	-1.3099	0.2894	18	-4.53	0.0003
conc	200	-0.6466	0.2493	18	-2.59	0.0183
conc	300	-0.4842	0.2438	18	-1.99	0.0624
conc	400	-1.1322	0.2758	18	-4.11	0.0007
Resi		2.2430	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	16.54	<.0001

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	0.418	18	0.160	1.095
50	400	0.806	18	0.346	1.876
100	400	0.837	18	0.361	1.939
200	400	1.625	18	0.744	3.549
300	400	1.912	18	0.882	4.142

conc Least Squares Means

conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	-2.0043	0.3660	18	-5.48	<.0001	0.05	-2.7733	-1.2354	0.1188	0.03830	0.05879	0.2252
50	-1.3477	0.2926	18	-4.61	0.0002	0.05	-1.9625	-0.7329	0.2063	0.04791	0.1232	0.3246
100	-1.3099	0.2894	18	-4.53	0.0003	0.05	-1.9180	-0.7018	0.2125	0.04844	0.1281	0.3314
200	-0.6466	0.2493	18	-2.59	0.0183	0.05	-1.1704	-0.1229	0.3438	0.05624	0.2368	0.4693
300	-0.4842	0.2438	18	-1.99	0.0624	0.05	-0.9964	0.02791	0.3813	0.05751	0.2696	0.5070
400	-1.1322	0.2758	18	-4.11	0.0007	0.05	-1.7116	-0.5529	0.2438	0.05083	0.1530	0.3652

Differences of conc Least Squares Means

conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	0.6566	0.4686	18	1.40	0.1781	0.05	-0.3279	1.6411	1.928	0.720	5.161
100	0	0.6944	0.4666	18	1.49	0.1540	0.05	-0.2859	1.6747	2.003	0.751	5.337
200	0	1.3577	0.4428	18	3.07	0.0067	0.05	0.4273	2.2881	3.887	1.533	9.856
300	0	1.5201	0.4398	18	3.46	0.0028	0.05	0.5962	2.4440	4.573	1.815	11.519
400	0	0.8721	0.4583	18	1.90	0.0732	0.05	-0.09070	1.8349	2.392	0.913	6.264

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

KW
27FEB15

AEH-11-PSEUDO-02

Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration

Overall Model: Juvenile Mussel Survival for each species

The GLIMMIX Procedure

form=SDP sps=PPB

Model Information	
Data Set	WORK.SURVIVAL
Response Variable (Events)	tdead
Response Variable (Trials)	tot
Response Distribution	Binomial
Link Function	Logit
Variance Function	Default
Variance Matrix	Diagonal
Estimation Technique	Maximum Likelihood
Degrees of Freedom Method	Residual

Class Level Information		
Class	**Levels**	**Values**
conc	6	0 50 100 200 300 400

Number of Observations Read	24
Number of Observations Used	24
Number of Events	659
Number of Trials	960

Dimensions	
Covariance Parameters	1
Columns in X	6
Columns in Z	0
Subjects (Blocks in V)	1
Max Obs per Subject	24

Optimization Information	
Optimization Technique	Newton-Raphson
Parameters in Optimization	6
Lower Boundaries	0
Upper Boundaries	0
Fixed Effects	Not Profiled

AEH-11-PSEUDO-02

Iteration History					
Iteration	Restarts	Evaluations	Objective Function	Change	Max Gradient
0	0	4	87.302288545	.	3.345498
1	0	3	86.019228322	1.28304022	0.200947
2	0	3	86.016091534	0.00313679	0.000929
3	0	3	86.016091475	0.00000006	2.02E-8

Convergence criterion (GCONV=1E-8) satisfied.

Fit Statistics	
-2 Log Likelihood	172.03
AIC (smaller is better)	184.03
AICC (smaller is better)	188.97
BIC (smaller is better)	191.10
CAIC (smaller is better)	197.10
HQIC (smaller is better)	185.91
Pearson Chi-Square	81.57
Pearson Chi-Square / DF	4.53

Parameter Estimates						
Effect	conc	Estimate	Standard Error	DF	t Value	Pr > |t|
conc	0	-0.7885	0.3631	18	-2.17	0.0435
conc	50	1.7845	0.4797	18	3.72	0.0016
conc	100	1.4663	0.4312	18	3.40	0.0032
conc	200	1.0010	0.3796	18	2.64	0.0168
conc	300	1.4663	0.4312	18	3.40	0.0032
conc	400	0.3795	0.3427	18	1.11	0.2827
Resi		4.5315	.	.	.	.

Type III Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
conc	6	18	8.31	0.0002

Odds Ratio Estimates					
conc	conc	Estimate	DF	95% Confidence Limits	
0	400	0.311	18	0.109	0.888
50	400	4.076	18	1.181	14.062
100	400	2.965	18	0.932	9.430
200	400	1.862	18	0.636	5.452
300	400	2.965	18	0.932	9.430

AEH-11-PSEUDO-02

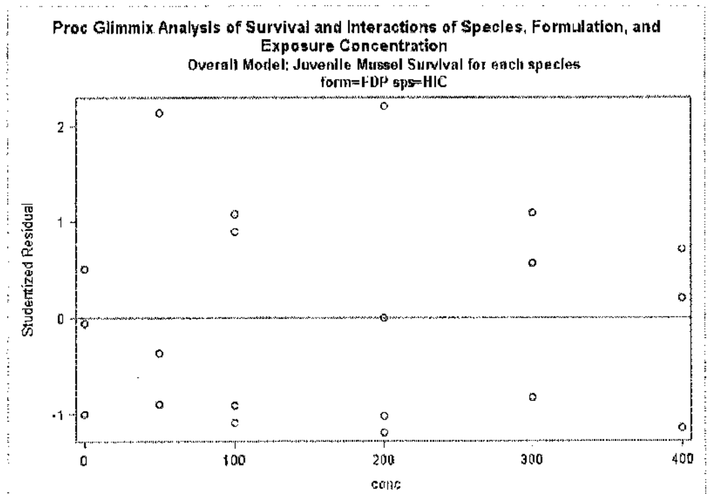
conc Least Squares Means												
conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Mean	Standard Error Mean	Lower Mean	Upper Mean
0	-0.7885	0.3631	18	-2.17	0.0435	0.05	-1.5613	-0.02566	0.3125	0.07801	0.1749	0.4936
50	1.7845	0.4797	18	3.72	0.0016	0.05	0.7767	2.7923	0.8562	0.05904	0.6850	0.9423
100	1.4663	0.4312	18	3.40	0.0032	0.05	0.5605	2.3722	0.8125	0.06569	0.6366	0.9147
200	1.0010	0.3796	18	2.64	0.0168	0.05	0.2034	1.7985	0.7312	0.07461	0.5507	0.8580
300	1.4663	0.4312	18	3.40	0.0032	0.05	0.5606	2.3722	0.8125	0.06569	0.6366	0.9147
400	0.3795	0.3427	18	1.11	0.2827	0.06	-0.3404	1.0994	0.5938	0.08265	0.4157	0.7501

Differences of conc Least Squares Means												
conc	conc	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio
50	0	2.5729	0.6016	18	4.28	0.0005	0.05	1.3090	3.8369	13.104	3.703	46.380
100	0	2.2548	0.5637	18	4.00	0.0008	0.05	1.0705	3.4390	9.533	2.917	31.157
200	0	1.7894	0.5253	18	3.41	0.0031	0.05	0.6858	2.8930	5.986	1.985	18.048
300	0	2.2548	0.5637	18	4.00	0.0008	0.05	1.0705	3.4390	9.533	2.917	31.157
400	0	1.1679	0.4992	18	2.34	0.0310	0.05	0.1191	2.2168	3.215	1.126	9.178

Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

MW 27FEB15

AEH-11-PSEUDO-02

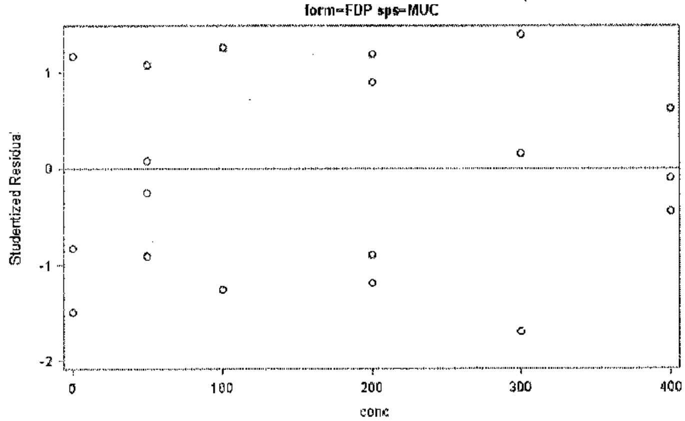


Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

KW 27FEB15

AEH-11-PSEUDO-02

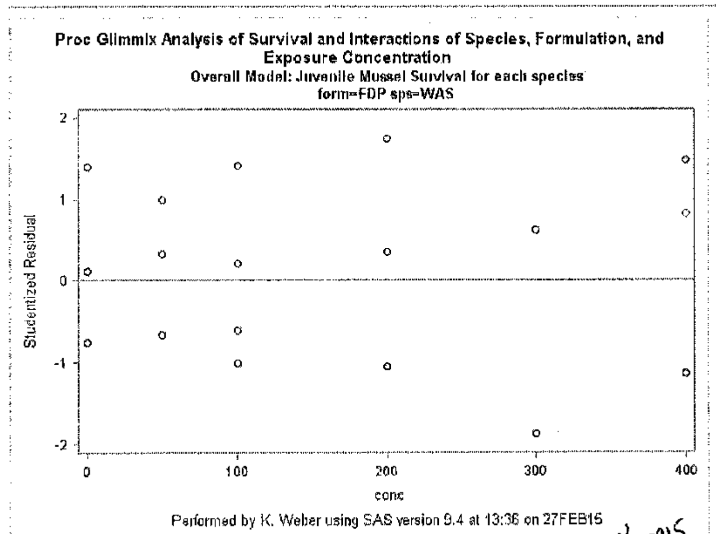
Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration
Overall Model: Juvenile Mussel Survival for each species
form=FDP sps=MUC



Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

KW 27FEB15

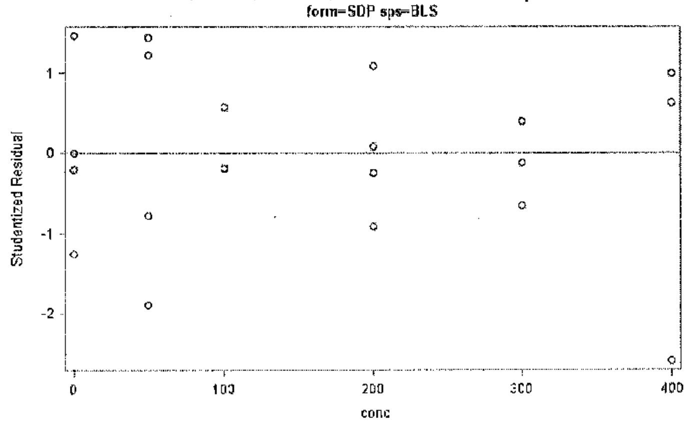
AEH-11-PSEUDO-02



KW 27FEB15

AEH-11-PSEUDO-02

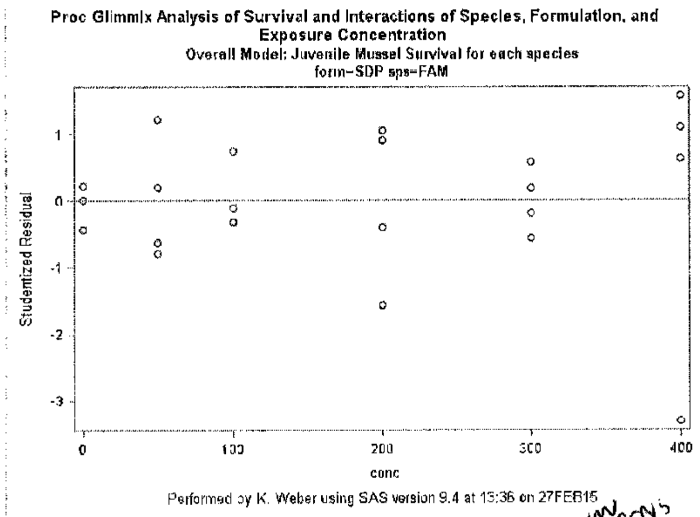
Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concentration
Overall Model: Juvenile Mussel Survival for each species
form=SDP sps=BLS



Performed by K. Weber using SAS version 9.4 at 13:36 on 27FEB15

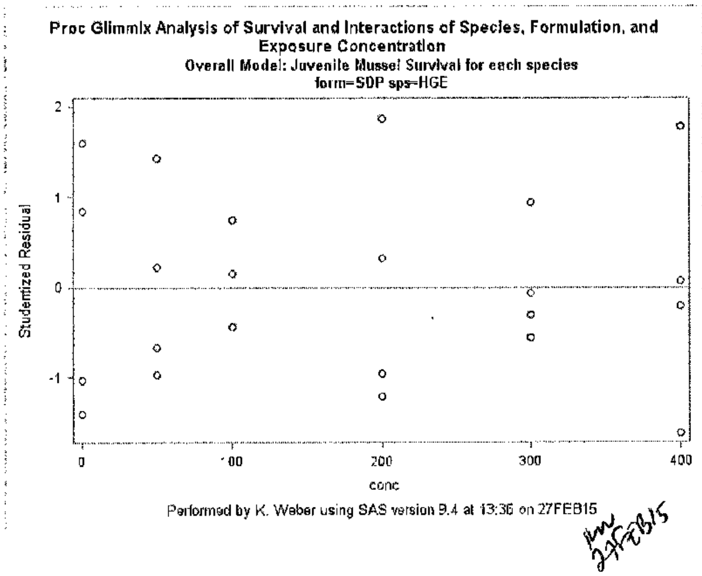
KW 27FEB15

AEH-11-PSEUDO-02

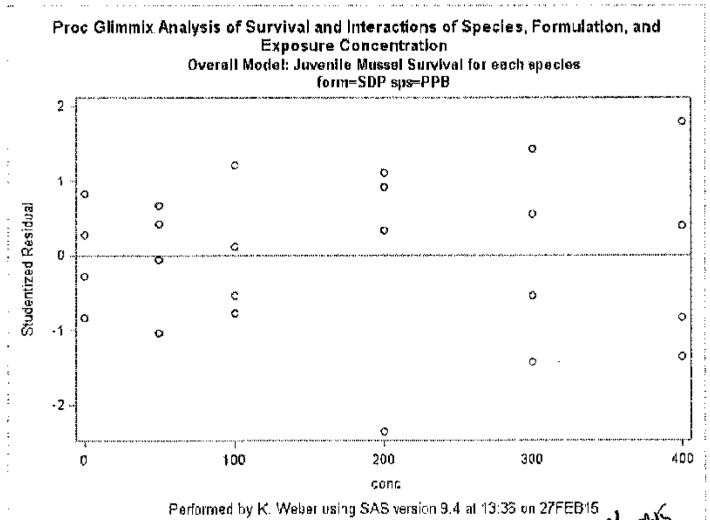


27FEB15

AEH-11-PSEUDO-02



AEH-11-PSEUDO-02



KW 27FEB15

FF # 11
Item No. 3
Pg 59 of 59

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber using SAS version ' "&SYSVER" ' at ' "&SYSTIME"  ' on ' "&SYSDATE";

options ls=97 ps=54 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=1.5 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile mussels 1
title2 h=1.5 'Statistical analysis of juvenile mussel recovery and suvival after';
title2 h=1.5 'exposure to various concentrations of Pf-CL145A';
title3 h=1.5 'SAS v. 9.4    Analysis completion date:  27 February 2014  Analysis prepared by: KLW';

/***************************************************
* SAS ver 9.4       Analysis prepared by:  KLW  KLW 2Feb15                AEH-11-PSEUDO-02
* Analysis completion date:  27 February 2015
**************************************************/

/**********************************************************************************************
*Variable Names:
* sps = three letter code for juvenile mussel species
*           BLS = Black sandshell (Ligumia recta)
*           FAM = Fatmucket (Lampsilis siliquoidea)
*           WAS = Washboard (Megalonaias nervosa)
*           HGE = Higgins eye (Lampsilis higginsii)
*           PPB = Plain pocketbook (Lapsilis cardium)
*           HIC = Hickorynut (Obovaria olivaria)
*           MUC = Mucket (Actinonaias ligamentina)
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
* conc = concentration (in mg/L)
*           0 = control (0 mg/L)
*           50 = 50 mg/L active ingredient
*           100 = 100 mg/L active ingredient
*           200 = 200 mg/L active ingredient
*           300 = 300 mg/L active ingredient
*           400 = 300 mg/L heat deative
* cham = exposure chamber ID
*             i.e., 3A5 = test system (1, 2, or 3), Block ID (A or B), and Position in Block (1 - 12)
* tot = total number of juvenile mussels placed in chamber prior to exposure (= 40)
* rec = number of recovered juvenile mussels during assessment
* via = number of viable juvenile mussels from the recovered mussels
* dead = number of dead juvenile mussels (= rec - via)
* unrec = number of animals not recovered during the assessment (= tot - rec)
* tdead = number of dead + number of unrecovered
**********************************************************************************************
data survival; set Pseudo02.survival;
pctsurv = (tot-tdead)/tot*100;
pctmort = tdead/tot*100;
pctrec = rec/tot*100;
run;

proc sort data=survival; by sps form conc; run;
proc print data=survival; title4 h=1 'All Juvenile Mussel Survival Data'; run;
title1 h=2 'Juvenile Mussel Recovery';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Percent recovery for each species';
proc sort data = survival; by form sps conc; run;
proc means data = survival;
```

FF # 11
Item No. 4
Pg 1 of 3

```
by form;
class sps;
var rec pctrec;
run;

title1 h=2 'Juvenile Mussel Recovery';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02  ;
title3 h=1.5 'Percent recovery for each species by treatment group';
proc means data = survival;
by form ;
class sps conc;
var rec pctrec;
run;

proc sort data=survival; by sps form conc; run;
proc univariate data = survival plots noprint;
title1 h=2  Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
class sps conc;
var pctsurv;
probplot pctsurv;
run;

title1 h=2  Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02  ;
title3 h=1.5 'Mean survival for each species ;
proc means data = survival;
by sps form;
class conc;
var pctsurv;
run;
title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02  ;
title3 h=1.5 'Mean survival for each species';
proc sort data=survival; by sps form conc; run;
proc sgplot data = survival;
vbox pctsurv/group=conc;
by sps;
run;

title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Mean survival for each formulation';
proc sort data=survival; by form conc; run;
proc means data = survival;
by form;
class conc;
var pctsurv;
run;
proc sort data=survival; by form conc; run;
proc sgplot data = survival;
vbox pctsurv/group=conc;
by form;
run;

title1 h=2 'Juvenile Mussel Survival';
```

AEH-11-PSEUDO-02

Page 2 of 3

```
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Mean survival for each formulation without BLS';
data surv; set survival;
If sps = "BLS" then delete;
run;
proc sort data=surv; by form conc; run;
proc means data = surv;
by form;
class conc;
var pctsurv;
run;
proc sgplot data = surv;
vbox pctsurv/group=conc;
by form;
run;

title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
Title 'Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and Exposure Concer
proc sort data=survival; by form sps conc; run;
proc glimmix data = survival;
title4 'Overall Model: Juvenile Mussel Survival for each species';
by form sps;
class conc;
model tdead/tot  = conc / d = bin link = logit noint s or;
    lsmeans conc / pdiff = control('0') cl ilink or;
    random _residual_;
    output out=outsurv pred=p resid=r student=student;
    run;

proc sgplot data=outsurv;
    scatter y=student x=conc;
    by form sps;
    refline 0/axis=y;
    run;
```

AEH-11-PSEUDO-02

JW 27FEB15

FF # 11
Item No. 4
Pg 3 of 3

```
DM 'LOG; CLEAR; OUTPUT; CLEAR;';  * CLEAR LOG AND OUTPUT;

FOOTNOTE1 'Performed by K. Weber using SAS version ' "&SYSVER" ' at ' '&SYSTIME" ' on '
"&SYSDATE";

options ls=97 ps=54 formdlim='-' pageno = 1 nocenter nodate nosource2;

title1 h=1.5 'Effects of Pseudomonas fluorescens (Pf-CL145A) to newly metamorphosed juvenile
 mussels from seven different unionid species';
title2 h=1.5 'Statistical analysis of juvenile mussel recovery and suvival after';
title2 h=1.5 'exposure to various concentrations of Pf-CL145A';
title3 h=1.5 'SAS v. 9.4    Analysis completion date:  27 February 2014  Analysis prepared
by: KLW';

/*****************************************************
* SAS ver 9.4      Analysis prepared by:  KLW
* Analysis completion date:  27 February 2015
*****************************************************/

/********************************************************************************************
*************
*Variable Names:
             *
* sps = three letter code for juvenile mussel species
             *
*            BLS = Black sandshell (Ligumia recta)
             *
*            FAM = Fatmucket (Lampsilis siliquoidea)
             *
*            WAS = Washboard (Megalonaias nervosa)
             *
*            HGE = Higgins eye (Lampsilis higginsii)
             *
*            PPB = Plain pocketbook (Lapsilis cardium)
             *
*            HIC = Hickorynut (Obovaria olivaria)
             *
*            MUC = Mucket (Actinonaias ligamentina)
             *
* form = formulation (FDP [freeze dried powder] vs. SDP [spray dried powder])
             *
* conc = concentration (in mg/L)
             *
*            0 = control (0 mg/L)
             *
*            50 = 50 mg/L active ingredient
             *
*            100 = 100 mg/L active ingredient
             *
*            200 = 200 mg/L active ingredient
             *
*            300 = 300 mg/L active ingredient
             *
*            400 = 300 mg/L heat deative
             *
* cham = exposure chamber ID
```

KW 27Feb15

AEH-11-PSEUDO-02

FF # 11
Item No. 5
Pg 1 of 7

```
35 !              *
36   *              i.e., 3A5 = test system (1, 2, or 3), Block ID (A or B), and Position in Block
36 !  (1 - 12)    *
37   * tot = total number of juvenile mussels placed in chamber prior to exposure (= 40)
37 !              *
38   * rec = number of recovered juvenile mussels during assessment
38 !              *
39   * via = number of viable juvenile mussels from the recovered mussels
39 !              *
40   * dead = number of dead juvenile mussels (= rec - via)
40 !              *
41   * unrec = number of animals not recovered during the assessment (= tot - rec)
41 !              *
42   * tdead = number of dead + number of unrecovered
42 !              *
43   ******************************************************************************************
43 ! ************/
44   data survival; set Pseudo02.survival;
45   pctsurv = (tot-tdead)/tot*100;
46   pctmort = tdead/tot*100;
47   pctrec = rec/tot*100;
48   run;

NOTE: There were 168 observations read from the data set PSEUDO02.SURVIVAL.
NOTE: The data set WORK.SURVIVAL has 168 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds


49
50   proc sort data=survival; by sps form conc; run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: The data set WORK.SURVIVAL has 168 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


51   proc print data=survival; title4 h=1 'All Juvenile Mussel Survival Data'; run;
NOTE: Writing HTML Body file: sashtml.htm
NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           2.12 seconds
      cpu time            0.56 seconds


52   title1 h=2 'Juvenile Mussel Recovery';
53   title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
54   title3 h=1.5 'Percent recovery for each species';
55   proc sort data = survival; by form sps conc; run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: The data set WORK.SURVIVAL has 168 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
```

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```
      real time           0.00 seconds
      cpu time            0.00 seconds


proc means data = survival;
by form;
class sps;
var rec pctrec;
run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.06 seconds
      cpu time            0.03 seconds
```

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```

title1 h=2 'Juvenile Mussel Recovery';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Percent recovery for each species by treatment group';
proc means data = survival;
by form ;
class sps conc;
var rec pctrec;
run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.07 seconds
      cpu time            0.09 seconds


proc sort data=survival; by sps form conc; run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: The data set WORK.SURVIVAL has 168 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


proc univariate data = survival plots noprint;
title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
class sps conc;
var pctsurv;
probplot pctsurv;
run;

NOTE: PROCEDURE UNIVARIATE used (Total process time):
      real time           4.32 seconds
      cpu time            0.68 seconds
```

```
title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Mean survival for each species';
proc means data = survival;
by sps form;
class conc;
var pctsurv;
run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.06 seconds
      cpu time            0.04 seconds
```

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```
title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Mean survival for each species';
proc sort data=survival; by sps form conc; run;

NOTE: Input data set is already sorted, no sorting done.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


proc sgplot data = survival;
vbox pctsurv/group=conc;
by sps;
run;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           1.28 seconds
      cpu time            0.23 seconds

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.


title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Mean survival for each formulation';
proc sort data=survival; by form conc; run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: The data set WORK.SURVIVAL has 168 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc means data = survival;
by form;
class conc;
var pctsurv;
run;
```

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```
NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds


proc sort data=survival; by form conc; run;

NOTE: Input data set is already sorted, no sorting done.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

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```
proc sgplot data = survival;
vbox pctsurv/group=conc;
by form;
run;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           0.29 seconds
      cpu time            0.03 seconds

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.


title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
title3 h=1.5 'Mean survival for each formulation without BLS';
data surv; set survival;
If sps = "BLS" then delete;
run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: The data set WORK.SURV has 144 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


proc sort data=surv; by form conc; run;

NOTE: There were 144 observations read from the data set WORK.SURV.
NOTE: The data set WORK.SURV has 144 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc means data = surv;
by form;
class conc;
var pctsurv;
run;

NOTE: There were 144 observations read from the data set WORK.SURV.
```

```
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.04 seconds
      cpu time            0.01 seconds


proc sgplot data = surv;
vbox pctsurv/group=conc;
by form;
run;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           0.48 seconds
      cpu time            0.11 seconds

NOTE: There were 144 observations read from the data set WORK.SURV.


title1 h=2 'Juvenile Mussel Survival';
title2 h=1.5 'Study Number AEH-11-PSEUDO-02 ';
Title 'Proc Glimmix Analysis of Survival and Interactions of Species, Formulation, and
Exposure Concentration';
proc sort data=survival; by form sps conc; run;

NOTE: There were 168 observations read from the data set WORK.SURVIVAL.
NOTE: The data set WORK.SURVIVAL has 168 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


proc glimmix data = survival;
title4 'Overall Model: Juvenile Mussel Survival for each species';
by form sps;
class conc;
model tdead/tot  = conc / d = bin link = logit noint s or;
    lsmeans conc / pdiff = control('0') cl ilink or;
    random _residual_;
    output out=outsurv pred=p resid=r student=student;
    run;



NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
NOTE: Convergence criterion (ABSGCONV=0.00001) satisfied.
NOTE: The above message was for the following BY group:
      form=FDP sps=HIC
NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
NOTE: Convergence criterion (GCONV=1E-8) satisfied.
NOTE: The above message was for the following BY group:
      form=FDP sps=MUC
NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
NOTE: Convergence criterion (GCONV=1E-8) satisfied.
NOTE: The above message was for the following BY group:
      form=FDP sps=WAS
NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
```

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```
NOTE: Convergence criterion (GCONV=1E-8) satisfied.
NOTE: The above message was for the following BY group:
      form=SDP sps=BLS
NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
NOTE: Convergence criterion (GCONV=1E-8) satisfied.
NOTE: The above message was for the following BY group:
      form=SDP sps=FAM
NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
NOTE: Convergence criterion (GCONV=1E-8) satisfied.
NOTE: The above message was for the following BY group:
      form=SDP sps=HGE
NOTE: The model does not contain an intercept. Columns of X are scaled only and not centered.
NOTE: Convergence criterion (GCONV=1E-8) satisfied.
NOTE: The above message was for the following BY group:
      form=SDP sps=PPB
NOTE: The data set WORK.OUTSURV has 168 observations and 16 variables.
NOTE: PROCEDURE GLIMMIX used (Total process time):
      real time           0.42 seconds
      cpu time            0.32 seconds
```

AEH-11-PSEUDO-02

```
proc sgplot data=outsurv;
    scatter y=student x=conc;
    by form sps;
    refline 0/axis=y;
    run;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           0.79 seconds
      cpu time            0.14 seconds

NOTE: There were 168 observations read from the data set WORK.OUTSURV.
```

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Weber and others—**Exposure-Related Effects of Pseudomonas fluorescens (Pf-CL145A) on Juvenile Unionid Mussels**—Open-File Report 2015–1066

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