



Ecotoxicology Research Facility



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January 4, 2017

Bruce Richart  
Berryville Waste Water Treatment  
1000 W. Cedarvale Road  
Berryville, AR 72616

Dear Bruce,

Please find enclosed the results of the 7-day chronic tests using water collected from the Berryville wastewater treatment facilities during the week of December 11, 2017. No lethal nor sublethal effects were measured in *Ceriodaphnia dubia* exposed to the treated effluent dilutions.

All test conditions and acceptability criteria as suggested by our laboratory and the US EPA, with the exception of the control reproduction as mentioned above, were met during these tests.

If you have any questions regarding this particular test series, please feel free to call.

Sincerely,

Jennifer L. Bouldin, PhD  
Director, Ecotoxicology Research Facility  
PO Box 847  
Arkansas State University  
State University, AR 72467

**Arkansas State University Ecotoxicology Research Facility**

**Laboratory Report**

Facility Director / Lab Contact: Jennifer Bouldin  
 Phone: (870) 972-2570

Client: Berryville Waste Water Treatment  
 1000 W. Cedarvale Road  
 Berryville, AR 72616

Contact: Bruce Richart  
 (479) 443-3292  
 (479) 443-5613 (f)

NPDES Permit #: AR0021792 AFIN#: 08-00034  
 Effluent Sampling Point/Type: 24hr Composite

Samples Collected:

| Sample # | Sampling Times                         | Received          | Arrival Temp |
|----------|--|-------------------|--------------|
| 1        | 12/10/17 0600 hrs to 12/11/17 0600 hrs | 12/12/17 0905 hrs | 0.5 °C       |
| 2        | 12/12/17 0600 hrs to 12/13/17 0600 hrs | 12/14/17 0909 hrs | 0.5 °C       |
| 3        | 12/14/17 0600 hrs to 12/15/17 0600 hrs | 12/16/17 0910 hrs | 0.5 °C       |

**Test Methods:**

7-Day Chronic Toxicity, Static renewal, Cladoceran, EPA 821/R-02/013, Section 13

Organisms: *C. dubia* <24hrs, < 24hrs

Culture Source: ASU ERF

Dilutions: 0%, 32%, 42%, 56%, 75%, 100%

Critical Dilution: 100%

Statistical Method: Toxcalc 5.0.25

*C. dubia*

| whole effluent toxicity |                |                            |
|-------------------------|----------------|----------------------------|
|                         | lethality      | sublethality               |
| DMR Code                | 22414 10       | 22414 P0                   |
| Result                  | 100%           | 100%                       |
|                         | lethality      | sublethality               |
| DMR Code                | TLP3B          | TGP3B                      |
| Result                  | 0              | 0                          |
|                         | NOEC lethality | NOEC sublethal             |
| DMR Code                | TOP3B          | TPP3B                      |
| Result                  | 100%           | 100%                       |
|                         | CV%            |                            |
| DMR Code                | TQP3B          |                            |
| Result                  | 38.8%          |                            |
| control survival        | 100%           | control mean reproduction  |
| critical dil. survival  | 100%           | 17.6                       |
|                         |                | critical mean reproduction |
|                         |                | 21.1                       |
|                         |                | MSDp                       |
|                         |                | 0.3858                     |

Results Summary: Neither lethal nor sublethal effects were measured to *C. dubia* at any effluent dilution.

QA/Reference Testing: Data attached

Reviewed By:

  
 Jennifer L. Bouldin, Director ASU Ecotoxicology Research Facility

Toxicity Test Performed: 7-day *Ceriodaphnia dubia* Survival and Reproduction  
 Effluent Sampling Point: Berryville Waste Water Plant  
 Date Test Started: 12/12/17 *C. dubia*  
 Time Test Started: 1100 *C. dubia*  
 Date Test Terminated: 12/19/17 *C. dubia*  
 Time Test Terminated: 1300 *C. dubia*  
 Laboratory Analyst: Cooper/Ruby

## I. Test Methods

- A. Physical and Chemical Testing - APHA, Standard Methods for the Examination of Water and Wastewater; Vol. 21, 2005.

| <u>Test</u>                        | <u>Method</u>         |
|------------------------------------|-----------------------|
| Alkalinity                         | 2320B                 |
| Conductivity                       | 2510B                 |
| Dissolved Oxygen (mg/L, DO)        | 4500-O-G              |
| Hardness (mg/L CaCO <sub>3</sub> ) | 2340C                 |
| pH                                 | 4500-H <sup>+</sup> B |
| Temperature (°C)                   | 2550B                 |

- B. Toxicity Testing – EPA 821/R-02/013: Short Term Methods for Estimating the Chronic Toxicity of Effluents to Freshwater Organisms

| <u>Test</u>                          | <u>Method</u> |
|--------------------------------------|---------------|
| Cladoceran Survival and Reproduction | Section 13    |

## II. Test Organisms

- A. Name: *Ceriodaphnia dubia* (Cladoceran)

Source: Laboratory Culture

Age: <24 hours

Life Stage: Neonate

- B. *Ceriodaphnia dubia*

Test Chambers: 30 ml Solo cups

Volume per Chamber: 15-20 ml

Number of Organisms per Chamber: 1

Number of Replicates per Concentration: 10

Acclimation: Laboratory control water was added to cultures until >50% of the culture water consisted of control water.

Food: Cladocera were fed *Selenastrum* (#ABS 112917) and yeast/cereal/trout chow mix (#YCT-ABS - 102017) one hour prior to test setup and once daily thereafter.

IV. Quality Assurance

A. Standard Toxicant: Sodium Chloride

B. Organism: *Ceriodaphnia dubia*

Date and time of Reference Toxicant Test

Start: 12/08/17

Terminated: 12/15/17

Time of Reference Toxicant Test

Start: 1241

Terminated: 1141

Laboratory Analyst: Martin

Dilution Water Used: Moderately Hard Synthetic Water #1005

Results: Survival and Reproduction within control limits

Survival

LOEC: 2.60 g/L NaCl

EC50: 2.11 g/L NaCl

Reproduction

LOEC: 1.82 g/L NaCl

IC25: 1.64 g/L NaCl

V. Physical and Chemical Data - See Attached

VI. Survival and Growth Data - See Attached

VII. Statistical Methods - See Attached

VIII. NPDES Permit Results - See Attached

**SUMMARY REPORTING FORM**  
**WET Testing**  
***Ceriodaphnia dubia* Survival and Reproduction**

Permittee: Berryville Waste Water Plant

NPDES No.: AR0021792

|              |                | <u>Time</u> | <u>Date</u> | to | <u>Time</u> | <u>Date</u> |
|--------------|----------------|-------------|-------------|----|-------------|-------------|
| Composite 1: | Collected from | 0600        | 12/10/17    |    | 0600        | 12/11/17    |
| Composite 2: | Collected from | 0600        | 12/12/17    |    | 0600        | 12/13/17    |
| Composite 3: | Collected from | 0600        | 12/14/17    |    | 0600        | 12/15/17    |

Test Initiated: 1100

Date: 12/12/17

Time Terminated: 1300

Date: 12/19/17

Dilution H<sub>2</sub>O: MH 1005

**PERCENT SURVIVAL**

| <u>Time of Reading</u> | <u>Percent Effluent</u> |            |            |            |            |             |
|------------------------|-------------------------|------------|------------|------------|------------|-------------|
|                        | <u>Control</u>          | <u>32%</u> | <u>42%</u> | <u>56%</u> | <u>80%</u> | <u>100%</u> |
| 24h                    | 100                     | 100        | 100        | 100        | 100        | 100         |
| 48h                    | 100                     | 100        | 100        | 100        | 100        | 100         |
| 7 day                  | 100                     | 100        | 100        | 100        | 100        | 100         |

**NUMBER OF YOUNG/FEMALE @ 7 DAYS**  
Percent Effluent

| <u>REP</u>  | <u>0%</u>   | <u>32%</u>  | <u>42%</u>  | <u>56%</u>  | <u>74%</u>  | <u>100%</u> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>A</b>    | 13          | 19          | 25          | 22          | 23          | 3           |
| <b>B</b>    | 10          | 29          | 18          | 34          | 22          | 21          |
| <b>C</b>    | 11          | 15          | 23          | 23          | 15          | 26          |
| <b>D</b>    | 17          | 25          | 21          | 22          | 23          | 21          |
| <b>E</b>    | 18          | 17          | 21          | 20          | 4           | 13          |
| <b>F</b>    | 17          | 5           | 4           | 26          | 26          | 29          |
| <b>G</b>    | 21          | 20          | 17          | 13          | 17          | 26          |
| <b>H</b>    | 23          | 22          | 10          | 22          | 22          | 28          |
| <b>I</b>    | 23          | 19          | 21          | 17          | 16          | 17          |
| <b>J</b>    | 23          | 26          | 29          | 24          | 26          | 27          |
| <b>Mean</b> | <b>17.6</b> | <b>19.7</b> | <b>18.9</b> | <b>22.3</b> | <b>19.4</b> | <b>21.1</b> |
| <b>CV%*</b> | <b>28.2</b> | <b>34.1</b> | <b>38.4</b> | <b>24.7</b> | <b>34.4</b> | <b>38.8</b> |

\*Coefficient of Variation% = Standard Deviation x 100/Mean

### ***Ceriodaphnia dubia* Survival and Reproduction**

1. FISHER'S EXACT TEST:  
Is the mean survival for the critical dilution (100%) at 7 days significantly different ( $p=0.05$ ) than the control survival?  
 Yes     No
  
2. DUNNETT'S PROCEDURE OR STEEL'S MANY-ONE RANK TEST AS APPROPRIATE:  
Is the mean number of young produced per female by the critical dilution (100%) significantly different ( $p=0.05$ ) than the control's number of young per female?  
 Yes     No
  
3. If the NOEC for survival is less than the critical dilution, enter [1], otherwise enter [0] for parameter #TLP3B: 0
  
4. If the NOEC for reproduction is less than the critical dilution, enter [1], otherwise enter [0] for parameter #TGP3B: 0
  
5. Report the NOEC value for survival, Parameter #TOP3B:  
NOEC survival 100% effluent
  
6. Report the NOEC value for reproduction, Parameter #TPP3B:  
NOEC reproduction 100% effluent
  
7. Report the % coefficient of variation (largest of critical and control dilutions), Parameter #TQP3B: CV % reproduction 38.8%(critical)

### **Whole Effluent Lethality Values for *Ceriodaphnia dubia***

1. Report the Whole Effluent Lethality values for the 30-Day average minimum, Parameter #22414:  
Daily Average Minimum NOEC: 100%
  
2. Report the Whole Effluent Lethality values for the 7-day minimum, Parameter #22414:  
7-Day Minimum NOEC: 100%

**SUMMARY REPORTING FORM**  
**WET Testing *Ceriodaphnia dubia* (Cladoceran)**  
**CHEMICAL PARAMETERS CHART**

Permittee: Berryville Waste Water Treatment  
 NPDES No.: AR0021792  
 Contact: Bruce Richart  
 Analyst: Cooper/Ruby

Sample No. 1 Collected Ending Date: 12/11/17 Time: 0600  
 Sample No. 2 Collected Ending Date: 12/13/17 Time: 0600  
 Sample No. 3 Collected Ending Date: 12/15/17 Time: 0600  
 Test Begin: Date: 12/12/17 Time: 1100 Test End: Date: 12/19/17 Time: 1300

| Initial Water Chemistry for Chronic Tests  |         |            |            |            |            |            |            |            |
|--|---------|------------|------------|------------|------------|------------|------------|------------|
| Project: Berryville WWTP – <i>C. dubia</i> |         |            |            |            |            |            |            |            |
| Test day                                   |         | 0          | 1          | 2          | 3          | 4          | 5          | 6          |
| Date                                       |         | 12/12/2017 | 12/13/2017 | 12/14/2017 | 12/15/2017 | 12/16/2017 | 12/17/2017 | 12/18/2017 |
| H <sub>2</sub> O #                         |         | MH1005     | MH1005     | MH1005     | MH1005     | MH1005     | MH1005     | MH1005     |
| Temp (°C)                                  | Control | 23.9       | 23.0       | 22.9       | 22.8       | 23.0       | 22.9       | 23.4       |
|  | 32%     | 22.8       | 23.0       | 23.1       | 22.9       | 22.9       | 23.0       | 23.4       |
|  | 42%     | 23.5       | 23.1       | 23.4       | 23.0       | 23.0       | 23.0       | 23.3       |
|  | 56%     | 23.9       | 23.0       | 23.6       | 22.9       | 22.9       | 23.1       | 23.4       |
|  | 75%     | 23.8       | 22.9       | 23.7       | 22.8       | 23.0       | 23.0       | 23.4       |
|  | 100%    | 24.0       | 23.0       | 24.0       | 22.8       | 23.1       | 23.2       | 23.4       |
| pH<br>(Standard Units)                     | Control | 7.58       | 7.69       | 7.66       | 7.71       | 7.33       | 7.58       | 7.59       |
|  | 32%     | 8.03       | 8.18       | 8.00       | 8.12       | 7.89       | 8.08       | 7.93       |
|  | 42%     | 8.09       | 8.24       | 8.07       | 8.18       | 7.99       | 8.13       | 7.96       |
|  | 56%     | 8.17       | 8.30       | 8.11       | 8.26       | 8.08       | 8.20       | 8.02       |
|  | 75%     | 8.24       | 8.35       | 8.10       | 8.32       | 8.15       | 8.25       | 8.06       |
|  | 100%    | 8.28       | 8.40       | 8.19       | 8.36       | 8.22       | 8.29       | 8.09       |
| DO<br>(mg/L)                               | Control | 8.7        | 8.7        | 8.8        | 8.6        | 8.6        | 8.9        | 8.9        |
|  | 32%     | 8.5        | 8.8        | 8.7        | 8.3        | 8.8        | 8.7        | 8.8        |
|  | 42%     | 8.4        | 8.7        | 8.5        | 8.2        | 8.4        | 8.4        | 8.4        |
|  | 56%     | 8.5        | 8.7        | 8.5        | 8.2        | 8.3        | 8.3        | 8.4        |
|  | 75%     | 8.5        | 8.6        | 8.5        | 8.2        | 8.3        | 8.3        | 8.5        |
|  | 100%    | 8.6        | 8.6        | 8.4        | 8.1        | 8.3        | 8.2        | 8.6        |
| Cond<br>(µS/cm)                            | Control | 269        | 267        | 269        | 270        | 270        | 269        | 267        |
|  | 32%     | 703        | 700        | 669        | 665        | 692        | 694        | 693        |
|  | 42%     | 839        | 828        | 798        | 788        | 820        | 828        | 821        |
|  | 56%     | 1022       | 1011       | 965        | 945        | 991        | 1003       | 995        |
|  | 75%     | 1323       | 1252       | 1211       | 1165       | 1227       | 1240       | 1229       |
|  | 100%    | 1657       | 1620       | 1540       | 1462       | 1588       | 1607       | 1584       |
| Alk<br>(mg/L)                              | Control | 58         |            | 58         |            | 58         |            |            |
|  | 100%    | 282        |            | 320        |            | 280        |            |            |
| Hard<br>(mg/L)                             | Control | 90         |            | 90         |            | 90         |            |            |
|  | 100%    | 105        |            | 95         |            | 90         |            |            |

**SUMMARY REPORTING FORM**  
**WET Testing *Ceriodaphnia dubia* (Cladoceran)**  
**CHEMICAL PARAMETERS CHART**

Permittee: Berryville Waste Water Treatment  
 NPDES No.: AR0021792  
 Contact: Bruce Richart  
 Analyst: Cooper/Ruby

Sample No. 1 Collected Ending Date: 12/11/17 Time: 0600  
 Sample No. 2 Collected Ending Date: 12/13/17 Time: 0600  
 Sample No. 3 Collected Ending Date: 12/15/17 Time: 0600  
 Test Begin: Date: 12/12/17 Time: 1100 Test End: Date: 12/19/17 Time: 1300

| <b>Final Water Chemistry for Chronic Tests</b> |         |            |            |            |            |            |            |            |
|--|---------|------------|------------|------------|------------|------------|------------|------------|
| Project: Berryville WWTP – <i>C. dubia</i>     |         |            |            |            |            |            |            |            |
| Test day                                       |         | 1          | 2          | 3          | 4          | 5          | 6          | 7          |
| Date:  |         | 12/12/2017 | 12/13/2017 | 12/14/2017 | 12/15/2017 | 12/16/2017 | 12/17/2017 | 12/18/2017 |
| H <sub>2</sub> O #                             |         | MH1005     | MH1005     | MH1005     | MH1005     | MH1005     | MH1005     | MH1005     |
| Temp (°C)                                      | Control | 22.8       | 22.6       | 22.9       | 23.8       | 23.7       | 24.2       | 24.3       |
|  | 32%     | 22.9       | 23.0       | 23.0       | 23.3       | 23.3       | 23.9       | 24.4       |
|  | 42%     | 22.9       | 23.2       | 23.2       | 22.9       | 23.7       | 23.3       | 24.3       |
|  | 56%     | 22.9       | 23.1       | 23.0       | 23.8       | 23.6       | 24.1       | 24.2       |
|  | 75%     | 22.9       | 23.5       | 22.9       | 23.2       | 23.2       | 23.7       | 24.2       |
|  | 100%    | 23.0       | 23.7       | 23.0       | 23.8       | 23.5       | 24.2       | 24.3       |
| pH<br>(Standard<br>Units)                      | Control | 8.23       | 8.08       | 8.11       | 7.76       | 8.12       | 7.80       | 8.00       |
|  | 32%     | 8.60       | 8.32       | 8.58       | 8.19       | 8.62       | 8.30       | 8.51       |
|  | 42%     | 8.69       | 8.62       | 8.66       | 8.23       | 8.71       | 8.34       | 8.60       |
|  | 56%     | 8.71       | 8.69       | 8.66       | 8.34       | 8.74       | 8.45       | 8.65       |
|  | 75%     | 8.78       | 8.69       | 8.74       | 8.39       | 8.79       | 8.50       | 8.72       |
|  | 100%    | 8.75       | 8.73       | 8.75       | 8.50       | 8.84       | 8.59       | 8.75       |
| DO<br>(mg/L)                                   | Control | 9.4        | 9.1        | 8.9        | 9.0        | 8.9        | 8.8        | 8.8        |
|  | 32%     | 9.7        | 8.7        | 9.2        | 8.9        | 9.0        | 8.7        | 8.5        |
|  | 42%     | 9.8        | 9.6        | 9.3        | 9.0        | 9.1        | 8.9        | 8.6        |
|  | 56%     | 9.9        | 9.6        | 9.4        | 8.9        | 9.2        | 8.9        | 8.6        |
|  | 75%     | 9.8        | 9.5        | 9.3        | 8.9        | 9.2        | 8.9        | 8.6        |
|  | 100%    | 8.9        | 9.4        | 9.4        | 8.9        | 9.3        | 8.9        | 8.6        |



**Ceriodaphnia Survival and Reproduction Test-7 Day Survival**

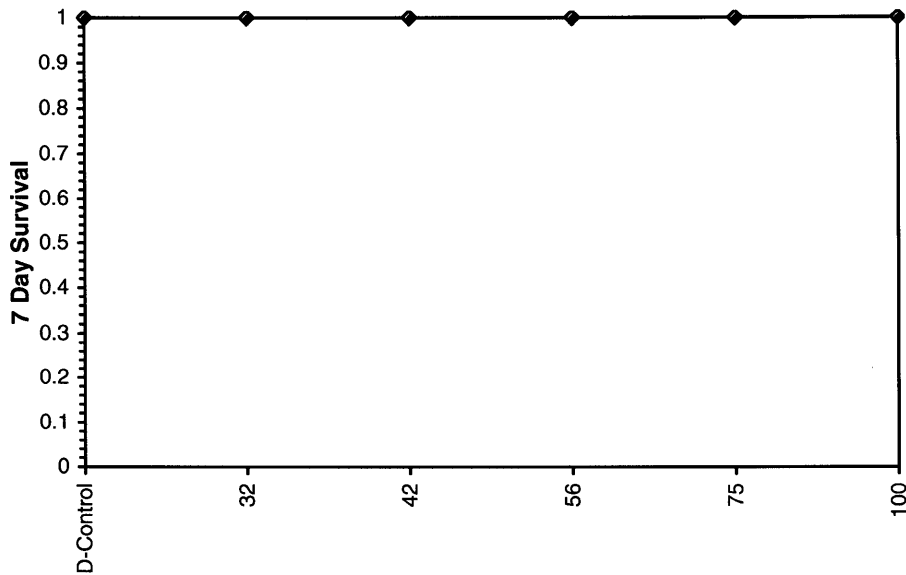
|                              |                                  |                                     |
|------------------------------|----------------------------------|-------------------------------------|
| Start Date: 12/12/2017 11:00 | Test ID: Berryville              | Sample ID: AR0021792-NPDES Permit # |
| End Date: 12/19/2017 13:00   | Lab ID: ASU-ERF                  | Sample Type: EFF1-POTW              |
| Sample Date: 12/11/2017      | Protocol: EPAF 02-EPA Freshwater | Test Species: CD-Ceriodaphnia dubia |
| Comments: Dec-17             |                                  |                                     |

| Conc-%    | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| D-Control | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 32        | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 42        | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 56        | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 75        | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 100       | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

| Conc-%    | Mean   | N-Mean | Resp | Not Resp | Total | N  | Fisher's Exact P | 1-Tailed Critical |
|-----------|--------|--------|------|----------|-------|----|------------------|-------------------|
| D-Control | 1.0000 | 1.0000 | 0    | 10       | 10    | 10 |                  |                   |
| 32        | 1.0000 | 1.0000 | 0    | 10       | 10    | 10 | 1.0000           | 0.0500            |
| 42        | 1.0000 | 1.0000 | 0    | 10       | 10    | 10 | 1.0000           | 0.0500            |
| 56        | 1.0000 | 1.0000 | 0    | 10       | 10    | 10 | 1.0000           | 0.0500            |
| 75        | 1.0000 | 1.0000 | 0    | 10       | 10    | 10 | 1.0000           | 0.0500            |
| 100       | 1.0000 | 1.0000 | 0    | 10       | 10    | 10 | 1.0000           | 0.0500            |

| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU |
|--------------------------------|------|------|-----|----|
| Fisher's Exact Test            | 100  | >100 |     | 1  |

**Dose-Response Plot**



**Ceriodaphnia Survival and Reproduction Test-Reproduction**

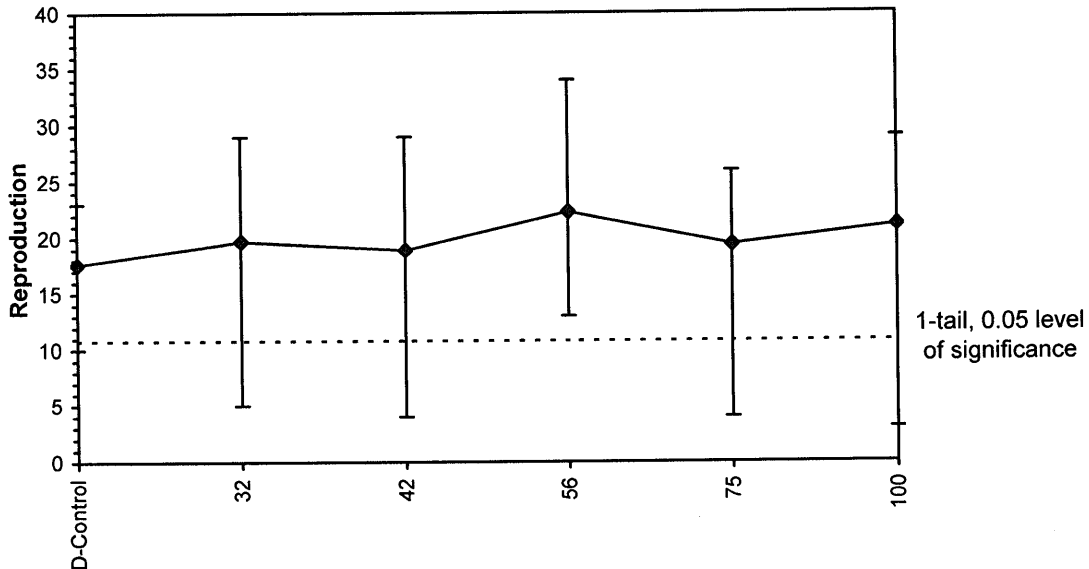
|                              |                                  |                                     |
|------------------------------|----------------------------------|-------------------------------------|
| Start Date: 12/12/2017 11:00 | Test ID: Berryville              | Sample ID: AR0024792-NPDES Permitt# |
| End Date: 12/19/2017 13:00   | Lab ID: ASU-ERF                  | Sample Type: EFF1-POTW              |
| Sample Date: 12/11/2017      | Protocol: EPAF 02-EPA Freshwater | Test Species: CD-Ceriodaphnia dubia |
| Comments: Dec-17             |                                  |                                     |

| Conc-%    | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| D-Control | 13.000 | 10.000 | 11.000 | 17.000 | 18.000 | 17.000 | 21.000 | 23.000 | 23.000 | 23.000 |
| 32        | 19.000 | 29.000 | 15.000 | 25.000 | 17.000 | 5.000  | 20.000 | 22.000 | 19.000 | 26.000 |
| 42        | 25.000 | 18.000 | 23.000 | 21.000 | 21.000 | 4.000  | 17.000 | 10.000 | 21.000 | 29.000 |
| 56        | 22.000 | 34.000 | 23.000 | 22.000 | 20.000 | 26.000 | 13.000 | 22.000 | 17.000 | 24.000 |
| 75        | 23.000 | 22.000 | 15.000 | 23.000 | 4.000  | 26.000 | 17.000 | 22.000 | 16.000 | 26.000 |
| 100       | 3.000  | 21.000 | 26.000 | 21.000 | 13.000 | 29.000 | 26.000 | 28.000 | 17.000 | 27.000 |

| Conc-%    | Mean   | N-Mean | Transform: Untransformed |        |        |        | N  | t-Stat | 1-Tailed Critical | MSD   |
|-----------|--------|--------|--------------------------|--------|--------|--------|----|--------|-------------------|-------|
|           |        |        | Mean                     | Min    | Max    | CV%    |    |        |                   |       |
| D-Control | 17.600 | 1.0000 | 17.600                   | 10.000 | 23.000 | 28.244 | 10 |        |                   |       |
| 32        | 19.700 | 1.1193 | 19.700                   | 5.000  | 29.000 | 34.098 | 10 | -0.707 | 2.287             | 6.790 |
| 42        | 18.900 | 1.0739 | 18.900                   | 4.000  | 29.000 | 38.434 | 10 | -0.438 | 2.287             | 6.790 |
| 56        | 22.300 | 1.2670 | 22.300                   | 13.000 | 34.000 | 24.747 | 10 | -1.583 | 2.287             | 6.790 |
| 75        | 19.400 | 1.1023 | 19.400                   | 4.000  | 26.000 | 34.381 | 10 | -0.606 | 2.287             | 6.790 |
| 100       | 21.100 | 1.1989 | 21.100                   | 3.000  | 29.000 | 38.790 | 10 | -1.179 | 2.287             | 6.790 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt   |        |         |         |         |         |       |
|--|-----------|----------|---------|--------|--------|---------|---------|---------|---------|-------|
| Kolmogorov D Test indicates normal distribution (p > 0.01) | 0.9964    | 1.035    | -0.8706 | 0.7807 |        |         |         |         |         |       |
| Bartlett's Test indicates equal variances (p = 0.74)       | 2.74953   | 15.0863  |         |        |        |         |         |         |         |       |
| Hypothesis Test (1-tail, 0.05)                             | NOEC      | LOEC     | ChV     | TU     | MSDu   | MSDp    | MSB     | MSE     | F-Prob  | df    |
| Dunnett's Test   | 100       | >100     |         | 1      | 6.7902 | 0.38581 | 27.5067 | 44.0889 | 0.68216 | 5, 54 |

**Dose-Response Plot**



**CHRONIC TEST DATA SHEET**  
*Ceriodaphnia dubia*

Project: Berryville Beginning Date: 12/2/17 Time: 1100 Test Species: C. dubia  
Dilution H<sub>2</sub>O: 1005 <sup>MH</sup> Ending Date: 12/9/17 Time: 1300 Age: <24 hours

Test Type: ( \* )Static Renewal ( ) Flowthrough Toxicant/Effluent:

| Conc.    | Rep     | Day 1 | Day 2 | Day 3 | Day 4   | Day 5   | Day 6   | Day 7   | Neonates |         |
|----------|---------|-------|-------|-------|---------|---------|---------|---------|----------|---------|
| Control  | 1       | 0     | 0     | 0     | 0       | 2       | 0       | 11      | 13       |         |
|          | 2       | ↓     | ↓     | ↓     | 0       | 2       | 8       | 0       | 10       |         |
|          | 3       |       |       |       | 0       | 2       | 0       | 9       | 11       |         |
|          | 4       |       |       |       | 3       | 4       | 0       | 10      | 17       |         |
|          | 5       |       |       |       | 0       | 6       | 0       | 12      | 18       |         |
|          | 6       |       |       |       | 5       | 4       | 0       | 8       | 17       |         |
|          | 7       |       |       |       | 1       | 6       | 0       | 14      | 21       |         |
|          | 8       |       |       |       | 5       | 8       | 0       | 10      | 23       |         |
|          | 9       |       |       |       | 6       | 8       | 0       | 9       | 23       |         |
|          | 10      |       |       |       | 0       | 5       | 8       | 10      | 23       |         |
| 32%      | 1       |       |       |       | 0       | 0       | 0       | 1       | 5        | 1       |
|          | 2       | ↓     | ↓     | ↓     | 7       | 0       | 7       | 15      | 0        | 29      |
|          | 3       |       |       |       | 0       | 1       | 5       | 0       | 9        | 15      |
|          | 4       |       |       |       | 6       | 5       | 0       | 14      | 25       |         |
|          | 5       |       |       |       | 3       | 6       | 0       | 8       | 17       |         |
|          | 6       |       |       |       | 1       | 0       | 4       | 0       | 5        |         |
|          | 7       |       |       |       | 0       | 0       | 9       | 11      | 20       |         |
|          | 8       |       |       |       | 2       | 1       | 9       | 10      | 22       |         |
|          | 9       |       |       |       | 0       | 2       | 8       | 9       | 19       |         |
|          | 10      |       |       |       | 0       | 0       | 10      | 16      | 26       |         |
| Date     | 12/2/17 |       |       |       | 12/3/17 | 12/4/17 | 12/5/17 | 12/6/17 | 12/7/17  | 12/8/17 |
| Initials | AWR     | AWR   | AWR   | RLC   | RLC     | RLC     | RLC     | RLC     |          |         |

**CHRONIC TEST DATA SHEET**  
*Ceriodaphnia dubia*

Project: Berryville Beginning Date: 12/21/17 Time: 1100 Test Species: C. dubia  
 Dilution H<sub>2</sub>O: 1005 <sup>MT</sup> Ending Date: 12/19/17 Time: 1300 Age: 24 hours

Test Type: ( \* )Static Renewal ( ) Flowthrough Toxicant/Effluent:

| Conc.    | Rep      | Day 1    | Day 2    | Day 3    | Day 4    | Day 5    | Day 6    | Day 7    | Neonates |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 42%      | 1        | 0        | 0        | 0        | 6        | 6        | 0        | 13       | 25       |
|          | 2        | ↓        | ↓        | ↓        | 0        | 5        | 0        | 13       | 18       |
|          | 3        | ↓        | ↓        | ↓        | 0        | 6        | 0        | 17       | 23       |
|          | 4        | ↓        | ↓        | ↓        | 4        | 6        | 11       | 0        | 21       |
|          | 5        | ↓        | ↓        | ↓        | 5        | 5        | 0        | 11       | 21       |
|          | 6        | ↓        | ↓        | ↓        | 4        | 0        | 0        | 0        | 4        |
|          | 7        | ↓        | ↓        | ↓        | 5        | 4        | 0        | 8        | 17       |
|          | 8        | ↓        | ↓        | ↓        | 3        | 5        | 0        | 2        | 10       |
|          | 9        | ↓        | ↓        | ↓        | 3        | 6        | 1        | 11       | 21       |
|          | 10       | ↓        | ↓        | ↓        | 5        | 6        | 0        | 18       | 29       |
| 56%      | 1        | 0        | 0        | 0        | 3        | 5        | 0        | 14       | 22       |
|          | 2        | ↓        | ↓        | 3        | 6        | 8        | 10       | 13       | 34       |
|          | 3        | ↓        | ↓        | 0        | 6        | 7        | 10       | 0        | 23       |
|          | 4        | ↓        | ↓        | ↓        | 3        | 7        | 0        | 12       | 22       |
|          | 5        | ↓        | ↓        | ↓        | 3        | 6        | 0        | 11       | 20       |
|          | 6        | ↓        | ↓        | ↓        | 4        | 7        | 0        | 15       | 26       |
|          | 7        | ↓        | ↓        | ↓        | 4        | 3        | 0        | 6        | 13       |
|          | 8        | ↓        | ↓        | ↓        | 6        | 6        | 0        | 10       | 22       |
|          | 9        | ↓        | ↓        | ↓        | 5        | 7        | 0        | 5        | 17       |
|          | 10       | ↓        | ↓        | ↓        | 2        | 0        | 8        | 14       | 24       |
| Date     | 12/21/17 | 12/13/17 | 12/14/17 | 12/15/17 | 12/16/17 | 12/17/17 | 12/18/17 | 12/19/17 |          |
| Initials | AWR      | AWR      | AWR      | RLC      | RLC      | RLC      | RLC      | RLC      |          |

**CHRONIC TEST DATA SHEET**  
*Ceriodaphnia dubia*

Project: Berryville Beginning Date: 12/2/17 Time: 1100 Test Species: C. dubia  
Dilution H<sub>2</sub>O: 100S <sup>wt</sup> Ending Date: 12/9/17 Time: 1300 Age: <24 hours

Test Type: ( \* )Static Renewal ( ) Flowthrough Toxicant/Effluent:

| Conc.    | Rep     | Day 1   | Day 2   | Day 3              | Day 4   | Day 5   | Day 6   | Day 7   | Neonates |
|----------|---------|---------|---------|--------------------|---------|---------|---------|---------|----------|
| 75%      | 1       | 0       | 0       | 0                  | 4       | 7       | 0       | 12      | 23       |
|          | 2       | ↓       | ↓       | 0                  | 3       | 7       | 0       | 12      | 22       |
|          | 3       | ↓       | ↓       | 4                  | 0       | 5       | 6       | 0       | 15       |
|          | 4       | ↓       | ↓       | 2                  | 0       | 10      | 11      | 0       | 23       |
|          | 5       | ↓       | ↓       | 0                  | 1       | 1       | 2       | 0       | 4        |
|          | 6       | ↓       | ↓       | ↓                  | 6       | 7       | 0       | 13      | 26       |
|          | 7       | ↓       | ↓       | ↓                  | 0       | 7       | 0       | 10      | 17       |
|          | 8       | ↓       | ↓       | ↓                  | 3       | 8       | 0       | 11      | 22       |
|          | 9       | ↓       | ↓       | ↓                  | 3       | 6       | 0       | 7       | 16       |
|          | 10      | ↓       | ↓       | ↓                  | 4       | 8       | 0       | 14      | 26       |
| 100%     | 1       | 0       | 0       | 3                  | 0       | 0       | 0       | 0       | 3        |
|          | 2       | ↓       | ↓       | 0                  | 5       | 7       | 9       | 0       | 21       |
|          | 3       | ↓       | ↓       | 0                  | 4       | 11      | 0       | 11      | 26       |
|          | 4       | ↓       | ↓       | 0                  | 4       | 6       | 0       | 11      | 21       |
|          | 5       | ↓       | ↓       | 2 <sup>rec</sup> 4 | 0       | 6       | 3       | 0       | 13       |
|          | 6       | ↓       | ↓       | 0                  | 7       | 11      | 11      | 0       | 29       |
|          | 7       | ↓       | ↓       | 0                  | 6       | 9       | 0       | 11      | 26       |
|          | 8       | ↓       | ↓       | 0                  | 4       | 10      | 0       | 14      | 28       |
|          | 9       | ↓       | ↓       | 0                  | 0       | 0       | 8       | 9       | 17       |
|          | 10      | ↓       | ↓       | 2                  | 3       | 9       | 0       | 13      | 27       |
| Date     | 12/2/17 | 12/3/17 | 12/4/17 | 12/5/17            | 12/6/17 | 12/7/17 | 12/8/17 | 12/9/17 |          |
| Initials | AWR     | AWR     | AWR     | RC                 | RC      | RC      | RC      | RC      |          |

Initial Water Chemistry for Chronic Tests  
Project: Berryville - C. dubia

| Test Day:                 |         | 0      | 1      | 2      | 3      | 4      | 5      | 6      |
|---------------------------|---------|--------|--------|--------|--------|--------|--------|--------|
| Date:                     |         | 12/2/7 | 12/3/7 | 12/4/7 | 12/5/7 | 12/6/7 | 12/7/7 | 12/8/7 |
| H <sub>2</sub> O Batch #: |         | MH1005 | MH1005 | MH1005 | MH1005 | MH1005 | MH1005 | MH1005 |
| Temp. (°C)                | Control | 23.9   | 23.0   | 22.9   | 22.8   | 23.0   | 22.9   | 23.4   |
|                           | 32%     | 22.8   | 23.0   | 23.1   | 22.9   | 22.9   | 23.0   | 23.4   |
|                           | 42%     | 23.5   | 23.1   | 23.4   | 23.0   | 23.0   | 23.0   | 23.3   |
|                           | 56%     | 23.9   | 23.0   | 23.4   | 22.9   | 22.9   | 23.1   | 23.4   |
|                           | 75%     | 23.8   | 22.9   | 23.7   | 22.8   | 23.0   | 23.0   | 23.4   |
|                           | 100%    | 24.0   | 23.0   | 24.0   | 22.8   | 23.1   | 23.2   | 23.4   |
| pH                        | Control | 7.58   | 7.69   | 7.66   | 7.71   | 7.33   | 7.58   | 7.59   |
|                           | 32%     | 8.03   | 8.18   | 8.00   | 8.12   | 7.89   | 8.08   | 7.93   |
|                           | 42%     | 8.09   | 8.24   | 8.07   | 8.18   | 7.99   | 8.13   | 7.96   |
|                           | 56%     | 8.17   | 8.30   | 8.11   | 8.26   | 8.08   | 8.20   | 8.02   |
|                           | 75%     | 8.24   | 8.35   | 8.14   | 8.32   | 8.15   | 8.25   | 8.06   |
|                           | 100%    | 8.28   | 8.40   | 8.19   | 8.36   | 8.22   | 8.29   | 8.09   |
| DO (mg/L)                 | Control | 8.7    | 8.7    | 8.8    | 8.6    | 8.6    | 8.9    | 8.9    |
|                           | 32%     | 8.5    | 8.8    | 8.7    | 8.3    | 8.8    | 8.7    | 8.8    |
|                           | 42%     | 8.4    | 8.7    | 8.5    | 8.2    | 8.4    | 8.4    | 8.4    |
|                           | 56%     | 8.5    | 8.7    | 8.5    | 8.2    | 8.3    | 8.3    | 8.4    |
|                           | 75%     | 8.5    | 8.6    | 8.5    | 8.2    | 8.3    | 8.3    | 8.5    |
|                           | 100%    | 8.6    | 8.4    | 8.4    | 8.1    | 8.3    | 8.2    | 8.6    |
| Cond. (µS/cm)             | Control | 269    | 267    | 269    | 270    | 270    | 269    | 267    |
|                           | 32%     | 703    | 700    | 669    | 665    | 692    | 694    | 693    |
|                           | 42%     | 839    | 828    | 798    | 788    | 820    | 828    | 821    |
|                           | 56%     | 1022   | 1011   | 965    | 945    | 991    | 1003   | 995    |
|                           | 75%     | 1323   | 1252   | 1211   | 1165   | 1227   | 1240   | 1229   |
|                           | 100%    | 1657   | 1620   | 1540   | 1462   | 1588   | 1607   | 1584   |
| Alk. (mg/L)               | Control | 58     |        | 58     |        | 58     |        |        |
|                           | 100%    | 282    |        | 320    |        | 280    |        |        |
| Hard. (mg/L)              | Control | 90     |        | 90     |        | 90     |        |        |
|                           | 100%    | 105    |        | 95     |        | 90     |        |        |
| Initials                  |         | AWR/AA | AWR    | AWR    | RIC    | RIC    | RIC    | RIC    |

**Final Water Chemistry for Chronic Tests**  
Project: Berryville - *C. dubia*

| Test Day:                 |         | 1       | 2        | 3        | 4        | 5        | 6        | 7        |
|---------------------------|---------|---------|----------|----------|----------|----------|----------|----------|
| Date:                     |         | 12/3/17 | 12/14/17 | 12/21/17 | 12/16/17 | 12/17/17 | 12/18/17 | 12/19/17 |
| H <sub>2</sub> O Batch #: |         | MH1005  | MH1005   | MH1005   | MH1005   | MH1005   | MH1005   | MH1005   |
| Temp. (°C)                | Control | 22.8    | 22.6     | 22.9     | 23.8     | 23.7     | 24.2     | 24.3     |
|                           | 32%     | 22.9    | 23.0     | 23.0     | 23.3     | 23.3     | 23.9     | 24.4     |
|                           | 42%     | 22.9    | 23.2     | 23.2     | 22.9     | 23.7     | 23.3     | 24.3     |
|                           | 56%     | 22.9    | 23.1     | 23.0     | 23.8     | 23.6     | 24.1     | 24.2     |
|                           | 75%     | 22.9    | 23.5     | 22.9     | 23.2     | 23.2     | 23.7     | 24.2     |
|                           | 100%    | 23.0    | 23.7     | 23.0     | 23.8     | 23.5     | 24.2     | 24.3     |
| pH                        | Control | 8.23    | 8.08     | 8.11     | 7.76     | 8.12     | 7.80     | 8.00     |
|                           | 32%     | 8.40    | 8.32     | 8.58     | 8.19     | 8.62     | 8.30     | 8.51     |
|                           | 42%     | 8.49    | 8.42     | 8.66     | 8.23     | 8.71     | 8.34     | 8.60     |
|                           | 56%     | 8.71    | 8.43     | 8.66     | 8.34     | 8.74     | 8.45     | 8.65     |
|                           | 75%     | 8.78    | 8.49     | 8.74     | 8.39     | 8.79     | 8.50     | 8.72     |
|                           | 100%    | 8.79    | 8.73     | 8.75     | 8.50     | 8.84     | 8.59     | 8.75     |
| DO (mg/L)                 | Control | 9.4     | 9.1      | 8.9      | 9.0      | 8.9      | 8.8      | 8.8      |
|                           | 32%     | 9.7     | 8.7      | 9.2      | 8.9      | 9.0      | 8.7      | 8.5      |
|                           | 42%     | 9.8     | 9.6      | 9.3      | 9.0      | 9.1      | 8.9      | 8.6      |
|                           | 56%     | 9.9     | 9.6      | 9.4      | 8.9      | 9.2      | 8.9      | 8.6      |
|                           | 75%     | 9.8     | 9.5      | 9.3      | 8.9      | 9.2      | 8.9      | 8.6      |
|                           | 100%    | 8.9     | 9.4      | 9.4      | 8.9      | 9.3      | 8.9      | 8.6      |
| Initials                  |         | QWR     | QWR      | RIC      | RIC      | RIC      | RIC      | RIC      |



**EcoTox**

Ecotoxicology Research Facility

**SAMPLE CHECK IN**

Sample ID Number: #1

Fill out this information with each effluent or river water sample coming in for testing. Keep completed sheets with test data and file with the lab QA/QC officer.

Date: 12/12/17 Sampling Date: 12/11/17 Arrival Time: 0905

Field Identification Number: \_\_\_\_\_ Description: POTW effluent

Shipped by: Federal Express  UPS \_\_\_\_\_ Hand delivered by: \_\_\_\_\_

Drop-Off Location: ASU-ERF

Storage While Shipped: cooler - ice

Analysis Requested: chronic dub

Initial Water Chemistry Analysis:

Sample Received by: JS

Temperature (°C): 0.5

Ice Present upon delivery:  YES  NO

Date: 12/12/17

| Quality Assurance             | Initial | Date     | Yes | No |
|-------------------------------|---------|----------|-----|----|
| Chain of Custody              | JS      | 12/12/17 | -   |    |
| Refrigerated at 4°C           | JS      | 12/12/17 | -   |    |
| Field Record Received         | JS      | 12/12/17 |     | -  |
| Sample Label Affixed Properly | JS      | 12/12/17 | -   |    |
| Project Leader Informed       | JS      | 12/12/17 | /   |    |

Comments: \_\_\_\_\_

\_\_\_\_\_





Ecotoxicology Research Facility

**SAMPLE CHECK IN**

Sample ID Number: #2

Fill out this information with each effluent or river water sample coming in for testing. Keep completed sheets with test data and file with the lab QA/QC officer.

Date: 12/14/17 Sampling Date: 12/13/17 Arrival Time: 0909

Field Identification Number: \_\_\_\_\_ Description: POTW effluent

Shipped by: Federal Express  UPS \_\_\_\_\_ Hand delivered by: \_\_\_\_\_

Drop-Off Location: ASU-ERF

Storage While Shipped: cooler w/ ice

Analysis Requested: chronic C. dubia

Initial Water Chemistry Analysis:

Sample Received by: EM

Temperature (°C): 0.5

Ice Present upon delivery:  YES  NO

Date: \_\_\_\_\_

| Quality Assurance             | Initial | Date     | Yes                                 | No                                  |
|-------------------------------|---------|----------|-------------------------------------|-------------------------------------|
| Chain of Custody              | EM      | 12/14/17 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| Refrigerated at 4°C           | EM      | 12/14/17 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| Field Record Received         | EM      | 12/14/17 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| Sample Label Affixed Properly | EM      | 12/14/17 | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Project Leader Informed       | EM      | 12/14/17 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |

Comments: \_\_\_\_\_



**EcoTox**

Ecotoxicology Research Facility

**SAMPLE CHECK IN**

Sample ID Number: #3

Fill out this information with each effluent or river water sample coming in for testing. Keep completed sheets with test data and file with the lab QA/QC officer.

Date: 12/6/17 Sampling Date: 12/4/17 - 12/5/17 Arrival Time: 0920

Field Identification Number: \_\_\_\_\_ Description: composite

Shipped by: Federal Express  UPS \_\_\_\_\_ Hand delivered by: \_\_\_\_\_

Drop-Off Location: ASU-ERF

Storage While Shipped: cooler w/ ice

Analysis Requested: chronic C. dubia

Initial Water Chemistry Analysis:

Sample Received by: RIC

Temperature (°C): 0.5 Ice Present upon delivery:  YES  NO

Date: 12/6/17

| Quality Assurance             | Initial | Date    | Yes | No |
|-------------------------------|---------|---------|-----|----|
| Chain of Custody              | RIC     | 12/6/17 | X   |    |
| Refrigerated at 4°C           | RIC     | ↓       | X   |    |
| Field Record Received         | RIC     |         |     | X  |
| Sample Label Affixed Properly | RIC     |         | X   |    |
| Project Leader Informed       | RIC     |         | X   |    |

Comments: \_\_\_\_\_

\_\_\_\_\_





