Scott A. Vance
General Counsel and Chief Ethics Officer
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April 30, 2019
GO2-19-065
DIC 1316.19

Ami Kidder
Siting and Compliance Manager
Energy Facility Site Evaluation Council
P.O. Box 47250
Olympia, WA 98504-7250

CERTIFIED MAIL
7016 3560 0001 0044 2531

Dear Ms Kidder:

SUBJECT: **ENERGY NORTHWEST COLUMBIA GENERATING STATION APPLICATION FOR RENEWAL OF NPDES PERMIT NO. WA002515-1**

REFERENCE:
1. NPDES Permit No. WA002515-1, Condition S6.
2. Letter, GI2-19-005, dated January 10, 2019, from A. Moon (EFSEC) to S. Khounnala (EN) "Columbia Generating Station, Energy Northwest (EN) National Pollutant Discharge Elimination System (NPDES) Permit No. WA002515-1 WQWebDMR Waiver for NPDES Renewal Application."

Condition S6 of the Energy Northwest Columbia Generating Station's (CGS) National Pollutant Discharge Elimination System (NPDES) permit (No. WA002515-1) requires the facility to submit an application for renewal by May 1, 2019. Condition S6 requires the permittee to submit a paper copy and electronic copy of the application. As per Reference 2 above, EFSEC waived the requirement to submit an electronic copy of the application on January 10, 2019.

This renewal application (Enclosure A) has been prepared on forms specified by the Department of Ecology. NPDES Permit Condition S14.A requires CGS to conduct chronic toxicity tests once per quarter in the year prior to submission of this renewal application and submit the results to EFSEC with the renewal application (Enclosure B). The results of the chronic toxicity tests have been uploaded onto Ecology's WQWebDMR website. This NPDES renewal also requires Cooling Water Intake Structure information to be submitted with the application. EPA Form 2-C Supplemental plus additional information required by Section B of EPA Form 2-C Supplement are included (Enclosure C).

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you require any additional information regarding this renewal application, please contact WK Whitehead at (509) 377-8794.

Sincerely,

X

Final Approver

Scott A. Vance
General Counsel

Attachments: 1. Enclosure A - NPDES Permit Renewal Application
2. Enclosure B – Chronic Toxicity Test Results
3. Enclosure C - EPA Form 2-C Supplemental

cc: A. Moon (EFSEC)
E. Ott (Ecology)
K. Hall (Ecology)
NRC Region IV Administration

SAV/nb

INTERNAL DISTRIBUTION:		**FILE COPY**	
Vance/lb		Columbia Files	964Y
		Docket File	PE20

ENCLOSURE A

NPDES PERMIT RENEWAL APPLICATION

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

For Approved. OMB No. 2040-0086. Approval expires 5-31-92

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

S		T/A	C
F	***WAD980738488***		D
1	2 13	14	15

LABEL ITEMS

- **I. EPA I.D. NUMBER**
- **III. FACILITY NAME**
- **V. FACILITY MAILING LIST**
- **VI. FACILITY LOCATION**

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area*(s)* below. If the label is complete and correct, you need not complete Items I, III, V, and VI*(except VI-B which must be completed regardless)*. Complete all items if no label has been proved. Refer to the instructions for detailed item descriptions and for the legal authorization under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental from listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	MARK "X" YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK "X" YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.?** (FORM 2A)	☐ 16	☒ 17	☐ 18	B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.?** (FORM 2B)	☐ 19	☒ 20	☐ 21
C. Is this facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	☒ 22	☐ 23	☒ 24	D. Is this proposal facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.?** (FORM 2D)	☐ 25	☒ 26	☐ 27
E. Does or will this facility treat, store, or dispose of **hazardous wastes?** (FORM 3)	☐ 28	☒ 29	☐ 30	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)	☐ 31	☒ 32	☐ 33
G. Do you or will you inject at this facility any produced water other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	☐ 34	☒ 35	☐ 36	H. Do you or will you inject at this facility fluids for special processes such as mining of sulfer by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	☐ 37	☒ 38	☐ 39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area?** (FORM 5)	☐ 40	☒ 41	☐ 42	J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment are?** (FORM 5)	☐ 43	☒ 44	☐ 45

III. NAME OF FACILITY

C	SKIP	
1		***Columbia Generating Station***
15	16-29	30 69

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
C 2 ***Whitehead, Wayde K., Principal Environmental Scientist***	***509*** ***377*** ***8794***
15 16 45	46 48 49 51 52 55

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX			
C 3 ***PO Box 968 (Mail Drop PE20)***			
15 16 45			
B. CITY OR TOWN	**C. STATE**	**D. ZIP CODE**	
C 4 ***Richland***	***WA***	***99352***	
15 16 40	41 42	47 51	

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER			
C 5 ***HANFORD - T11N R28E SEC 5***			
15 16 45			
B. COUNTY NAME			
Benton			
46 70			
C. CITY OR TOWN	**D. STATE**	**E. ZIP CODE**	**F. COUNTY CODE**
C 6 ***North of Richland***	***WA***	***99354***	***005***
15 16 40	41 42	47 51	52 54

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST	B. SECOND
4911 (specify) Electric Services	(specify)
C. THIRD	**D. FOURTH**
(specify)	(specify)

VIII. OPERATOR INFORMATION

A. NAME: Energy Northwest

B. Is the name listed in Item VIII-A also the owner? ☒ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other," specify.)*

F = FEDERAL; S = STATE; P = PRIVATE; M = PUBLIC *(other than federal or state)*; O = OTHER *(specify)*

M (specify)

D. PHONE *(area code & no.)*: A 509 372 5000

E. STREET OR PO BOX: PO Box 968

F. CITY OR TOWN: Richland

G. STATE: WA

H. ZIP CODE: 99352

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*: WA-002515-1	D. PSD *(Air Emissions from Proposed Sources)*: NA	
B. UIC *(Underground Injection of Fluids)*: NA	E. OTHER *(specify)*: See attached sheet	(Specify)
C. RCRA *(Hazardous Wastes)*: NA	E. OTHER *(specify)*	(Specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

Construction and operation of electric energy generation facilities and provider of energy related services.

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
Scott A. Vance, Vice President/General Counsel		4/29/19

COMMENTS FOR OFFICIAL USE ONLY

C

Attachment to FORM 1

Item X.E Other Existing Environmental Permits and Licenses

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Authorized
Washington Energy Facility Site Evaluation Council	RCW 80.50, WAC Title 463	State Permit to construct and operate	N/A	Issued: 05/17/1972	Construction and operation of CGS
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10CFR50.10	License to operate	NPF-21	Issued: 12/20/1983 Expires: 12/20/2043	Operation of CGS
Washington Energy Facility Site Evaluation Council	RCW 80.50, WAC Title 463	Resolution	288	Issued: 11/10/1997	Operation of inert waste landfill
Washington Energy Facility Site Evaluation Council	RCW 80.50, WAC Title 463	Resolution	299	Issued: 08/3/2001	Onsite disposal of cooling system sediment
Washington Energy Facility Site Evaluation Council	RCW 80.50, WAC Title 463	Resolution	300	Issued: 09/10/2001	Operation of sanitary waste treatment facility (1)
U.S. Army Corps of Engineers	Sec. 10 of Rivers and Harbors Act (33 USC 403), 33 CFR 330	Permit	071-OYC-1-000221-75-9	Issued: 03/14/1975	Construction and maintenance of river intake and discharge structures
Washington Department of Natural Resources	RCW 79.90 & 79.96	Easement	51-076659	Issued: 04/02/2005 Expires: 04/01/2035	Use of aquatic lands (riverbed and shoreline) for construction of in-river structures
Washington Department of Ecology	RCW 90.03, 90.16, & 43.21A, WAC 173-152 & 508-12	Certificate	S3-20141C	Issued: 02/04/1983	Withdrawal and consumption of surface water

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Authorized
Washington Department of Ecology	RCW 90.03, 90.16, & 43.21A, WAC 173-152 & 508-12	Certificate	G3-20142C	Issued: 05/02/1979	Withdrawal and consumption of groundwater
Washington Energy Facility Site Evaluation Council	RCW 70.94 & 80.50, WAC 173-401-300, 173-400-091 & 463-39	Order	873	Issued: 10/08/2014	Air emissions
Washington Energy Facility Site Evaluation Council	RCW 70.94 & 80.50, WAC 173-400, 173-460, & 463-39	Order	837	Issued: 02/11/2009	Air emissions from painting and blasting
Washington Department of Ecology (through Dept of Licensing)	RCW 90.76, WAC 173-360	Registration	034 003 333	Annual registration	Operation of underground storage tanks
Washington Department of Health	RCW 70.119A, WAC 246-294	Permit	920240	Annual registration	Operation of public water system
Washington Department of Ecology	RCW 43-200, WAC 173-326	Permit	G1018	Annual permit	Use of commercial low level radwaste disposal facility
U.S. Nuclear Regulatory Commission and National Marine Fisheries Service	Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) Section 7(a)(2)	License to Operate	NPF-21	Issued: 03/10/2017	Final Biological Opinion and Incidental Take Statement
Washington Energy Facility Site Evaluation Council	RCW 70.94.331, 70.94.442 & 80.50, WAC 463-78-070 & Chapter 246-247 WAC.	Order	874	01/21/2015	Manage and Regulate Fugitive Radionuclide Emissions from Evaporation Ponds (2)

Notes:

(1) Sanitary Waste Treatment Facility (SWTF) Waste Discharge Permit application submitted to EFSEC in 2018. Once issued the Waste Discharge Permit is to supersede Resolution 300.

(2) Columbia Generating Station Site-Wide Radioactive Air Emissions License application submitted in 2018.

W 119° 21' 57.221"
N 46° 29' 33.571"

W 119° 15' 2.341"
N 46° 29' 41.948"

N 46° 26' 31.234"
W 119° 21' 49.321"

N 46° 26' 39.596"
W 119° 14' 54.825"

-119° 21'
-119° 20'
-119° 19'
-119° 18'
-119° 17'
-119° 16'
-119° 15'

46° 29'
46° 28'
46° 27'

Ashe Substation
EVAPORATION PONDS
Radioactive Waste Dump
Col Gen Sta
MWSA
Met Twr
Well
Well
Well
WT
Sanitary Wste Trtmnt Facility
WTs
Lease Area Boundary
Test Well
Borrow Pit
Lease Area Boundary
Outfall 001
BOUNDARY
Benton
Drain
Brass
Drain
FRANKLIN CO
BENTON CO
Homestead
Island
Substation
HANFORD SITE
RIVER
MNWR
MNWR
Tower 404
BM 491
BM 467

1927 North American Datum; 1,000-meter UTM grid zone 11
Generated by BigTopo (www.igage.com)
Map compiled from USGS Quads: Wooded Island, WA Mathews Corner, WA

0 ¼ ½ 1 2 Miles
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

Attachment to Form 1
Item IX. Location Map

Please print or type in the unshaded areas only.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
WAD980738488

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM 2C NPDES

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
001	46.00	28.00	16.20	119.00	15.00	48.60	Columbia River

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUTFALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001 (a)	Circulating Cooling Water Blowdown	1.91 MGD	Disinfection by halogenation; dechlorination	2-F	2-E
			Neutralization	2-K	
			Discharge to river	4-A	
			Sediment disposed onsite	5-Q	
001 (b)	Radioactive Waste Treatment System	No Discharge	Filtration	1-N	
	Effluent		Ion Exchange	2-J	
			Infrequent batch discharge to river	4-A	
001 (c)	Standby Service Water	No Discharge	Disinfection	2-H	
			Infrequent batch discharge to river	4-A	
NA (d)	Potable Water Treatment	0.011 MGD	Double-lined ponds: Evaporation	1-F	
			intermittent use for maintenance	3-F	
			Sediment disposal to landfill	5-Q	
NA (e)	Demineralized Water Treatment	0.007 MGD	Double-lined ponds: Evaporation	1-F	
			intermittent use for maintenance	3-F	
NA (f)	Nonrad Plant Equipment	<0.002 MGD (estimate)	Intermittent collection in double-lined	1-F	
			evaporation ponds		
			TABLE II.B. CONTINUED IN ATTACHMENT 1		

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☑ YES (*complete the following table*) ☐ NO (*go to Section III*)

1. OUTFALL NUMBER (*list*)	2. OPERATION(s) CONTRIBUTING FLOW (*list*)	3. FREQUENCY		4. FLOW				
		a. DAYS PER WEEK (*specify average*)	b. MONTHS PER YEAR (*specify average*)	a. FLOW RATE (*in mgd*)		B. TOTAL VOLUME (*specify with units*)		C. DURATION (*in days*)
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	
	See Attachment 1 Table II.C.							

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☑ YES (*complete Item III-B*) ☐ NO (*go to Section IV*)

B. Are the limitations in the applicable effluent guideline expressed in terms of production (*or other measure of operation*)?

☐ YES (*complete Item III-C*) ☑ NO (*go to Section IV*)

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION			2. AFFECTED OUTFALLS (*list outfall numbers*)
a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (*specify*)	

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operations of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES (*complete the following table*) ☑ NO (*go to Item IV-B*)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE	
	a. NO.	b. SOURCE OF DISCHARGE		a. REQUIRED	b. PROJECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (*or other environmental projects which may affect your discharges*) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

☒ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

CONTINUED FROM PAGE 2

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
Asbestos (Outfall 001)	Possible leaching or erosion from asbestos cement cooling tower fill. Condition S2.A of the permit required a single grab sample once during the permit cycle. Effluent was sampled 11/13/2018 and analyzed by EPA 100.1 for wastewater. Analytical results are less than the detection limit, or <17.0 MFL MFL=million fibers per liter		

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ YES (*list all such pollutants below*) ☑ NO (*go to Item VI-B*)

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☑ YES (*identify the test(s) and describe their purposes below*) ☐ NO (*go to Section VIII*)

Whole Effluent Toxicity (WET) testing was performed on the final effluent, quarterly, including the last three years, by Energy Northwest in accordance with Special Condition S13 Acute Toxicity. The WET tests for acute toxicity were performed to meet the requirements of the permit and to verify the concentration of pollutants at the acute mixing zone meets the acute aquatic life criteria. Results of these tests show there was no acute toxicity detected in the test concentration representing the acute critical effluent concentration.

WET testing for Chronic Toxicity was performed on the final effluent, quarterly during the last calendar year of the permit cycle, to meet Special Condition S14. Chronic toxicity tests were performed to demonstrate that the effluent meets chronic aquatic life criteria and human health criteria. Results of these test show there was no chronic toxicity in test concentrations representing the chronic critical effluent concentration. Chronic Toxicity test results are included as an attachment to this permit application, as required by the permit.

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☑ YES (*list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below*) ☐ NO (*go to Section IX*)

A. NAME	B. ADDRESS	C. TELEPHONE (*area code & no.*)	D. POLLUTANTS ANALYZED (*list*)
EMSL Analytical	200 Route 130 North Cinnaminson, NJ 08077	(856) 786-5974	Asbestos
Anatek Labs	1282 Alturas Drive, Moscow, ID 83843	(208) 883-2839	Volatile, semivolatile organics, mercury, boron, TKN, oil & grease, cyanide, total phenols
Benton-Franklin Health District	7102 W. Okanogan Place Kennewick, WA 99336	(509) 460-4200	BOD, fecal coliform
Edge Analytical	1620 S Walnut St Burlington, WA 98233	(360) 757-1400	Bromide, color

IX. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE (*type or print*)	B. PHONE NO. (*area code & no.*)
Scott Vance, Vice President/General Counsel	(509) 377-4650
C. SIGNATURE	D. DATE SIGNED
	4/29/19

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages.
SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*): WAD980738488

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)* — OUTFALL NO. 001

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	3. UNITS (*specify if blank*) a. CONCENTRATION	3. UNITS b. MASS	4. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Biochemical Oxygen Demand (*BOD*)	<2.0				<2.0		3	mg/L				
b. Chemical Oxygen Demand (*COD*)	39				37		3	mg/L				
c. Total Organic Carbon (*TOC*)	15				13		3	mg/L				
d. Total Suspended Solids (*TSS*)	45				9.1		37	mg/L				
e. Ammonia (*as N*)	0.250				0.071		37	mg/L		0.041		37 grab
f. Flow	VALUE 5.8		VALUE 3.2		VALUE 1.91		1096	MGD		VALUE		
g. Temperature (*winter*)	VALUE 33.1		VALUE 27.9		VALUE 23.3		cont.	°C		VALUE		
h. Temperature (*summer*)	VALUE 35.9		VALUE 32.7		VALUE 26.4		cont.	°C		VALUE		
i. pH	MINIMUM 7.1	MAXIMUM 8.6	MINIMUM	MAXIMUM			cont.	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X" a. BELIEVED PRESENT	2. MARK "X" b. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	a. MAXIMUM DAILY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVRG. VALUE (*if available*) (2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE b. NO. OF ANALYSES
a. Bromide (24959-67-9)	X		16.0		NA		13.6		3	mg/L				
b. Chlorine, Total Residual	X		<0.1		NA		<0.1		3	mg/L				
c. Color	X		10		NA		10		3	CU				
d. Fecal Coliform	X		7.8		NA		3.3		3	Col/100m				
e. Fluoride (16984-48-8)	X		0.90		NA		0.65		37	mg/L		0.06		37 grab
f. Nitrate-Nitrite (*as N*)	X		3.25		NA		1.24		37	mg/L		0.13		37 grab

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)	X		1.52		NA		1.35		3	mg/L				
h. Oil and Grease	X		<1		NA		0		4	mg/L				
i. Phosphorus (as P), Total (7723-14-0)	X		3.44		NA		2.68		37	mg/L				
j. Radioactivity														
(1) Alpha, Total		X			NA									
(2) Beta, Total	X		17.1		NA		7.48		36	pCi/L				
(3) Radium, Total		X			NA									
(4) Radium 226, Total		X			NA									
k. Sulfate (*as SO_4*) (14808-79-8)	X		760		NA		572		37	mg/L				
l. Sulfide (*as S*)		X			NA									
m. Sulfite (*as SO_3*) (14265-45-3)	X		<5 (est)		NA		NA		0	mg/L				
n. Surfactants	X		<5 (est)		NA		NA		0	mg/L				
o. Aluminum, Total (7429-90-5)	X		0.18		NA		0.18		3	mg/L				
p. Barium, Total (7440-39-3)	X		0.37		NA		0.28		37	mg/L		0.03		37 grab
q. Boron, Total (7440-42-8)	X		0.0479		NA		0.0378		3	mg/L				
r. Cobalt, Total (7440-48-4)	X		0.00042		NA		0.00041		3	mg/L				
s. Iron, Total (7439-89-6)	X		1.3		NA		0.37		37	mg/L		0.051		37 grab
t. Magnesium, Total (7439-95-4)	X		58		NA		44		37	mg/L		4.2		37 grab
u. Molybdenum, Total (7439-98-7)	X		0.0081		NA		0.0079		3	mg/L				
v. Manganese, Total (7439-96-5)	X		0.092		NA		0.034		37	mg/L		0.003		37 grab
w. Tin, Total (7440-31-5)	X		<0.001		NA		<0.001		3	mg/L				
x. Titanium, Total (7440-32-6)	X		0.066		NA		0.019		37	mg/L		0.0023		37 grab

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
WAD980738488	001

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)			X	0.0016		NA		0.0012		3	mg/L				
2M. Arsenic, Total (7440-38-2)		X		0.0095		NA		0.0064		37	mg/L		0.0006		37grb
3M. Beryllium, Total (7440-41-7)			X	<0.0005		NA		0		4	mg/L				
4M. Cadmium, Total (7440-43-9)			X	0.0002		NA		0.00001		37	mg/L		0		37grb
5M. Chromium, Total (7440-47-3)		X		0.0023		NA		0.0007		37	mg/L		0.00026		37grb
6M. Copper, Total (7440-50-8)		X		0.024		NA		0.015		37	mg/L		0.0002		37grb
7M. Lead, Total (7439-92-1)		X		0.0035		NA		0.0009		37	mg/L		0.00002		37grb
8M. Mercury, Total (7439-97-6)			X	0.00183		NA		0.00159		3	ug/L				
9M. Nickel, Total (7440-02-0)		X		0.0120		NA		0.0077		37	mg/L		0.0009		37grb
10M. Selenium, Total (7782-49-2)			X	0.0074		NA		0.0036		37	mg/L		0.0002		37grb
11M. Silver, Total (7440-22-4)			X	0.00024		NA		0.000015		37	mg/L		0		37grb
12M. Thallium, Total (7440-28-0)			X	<0.0002		NA		0		3	mg/L				
13M. Zinc, Total (7440-66-6)		X		0.051		NA		0.020		37	mg/L		0.0009		37grb
14M. Cyanide, Total (57-12-5)			X	<0.01		NA		NA		1	mg/L				
15M. Phenols, Total			X	<0.05		NA		NA		1	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)		X		DESCRIBE RESULTS Dioxin is expected to be present solely as a result of its presence in the intake water. There is an existing TMDL for Dioxin on the Columbia River. Long-term average from three (3) composite samples is 0 pg/L.											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)	X		X	<0.5		NA		0		4	ug/L				
2V. Acrylonitrile (107-13-1)	X		X	<0.4		NA		0		4	ug/L				
3V. Benzene (71-43-2)	X		X	<0.1		NA		0		4	ug/L				
4V. Bis (*Chloro-methyl*) Ether (542-88-1)			X			NA				0					
5V. Bromoform (75-25-2)	X	X		0.63		NA		0.20		4	ug/L				
6V. Carbon Tetrachloride (56-23-5)	X		X	<0.1		NA		0		4	ug/L				
7V. Chlorobenzene (108-90-7)	X		X	<0.1		NA		0		4	ug/L				
8V. Chlorodi-bromomethane (124-48-1)	X		X	<0.1		NA		0		4	ug/L				
9V. Chloroethane (75-00-3)	X		X	<0.1		NA		0		4	ug/L				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	X		X	<0.5		NA		0		4	ug/L				
11V. Chloroform (67-66-3)	X		X	<0.1		NA		0		4	ug/L				
12V. Dichloro-bromomethane (75-27-4)	X		X	<0.1		NA		0		4	ug/L				
13V. Dichloro-difluoromethane (75-71-8)			X	<0.1		NA		NA		1	ug/L				
14V. 1,1-Dichloro-ethane (75-34-3)	X		X	<0.1		NA		0		4	ug/L				
15V. 1,2-Dichloro-ethane (107-06-2)	X		X	<0.1		NA		0		4	ug/L				
16V. 1,1-Dichloro-ethylene (75-35-4)	X		X	<0.1		NA		0		4	ug/L				
17V. 1,2-Dichloro-propane (78-87-5)	X		X	<0.1		NA		0		4	ug/L				
18V. 1,3-Dichloro-propylene (542-75-6)	X		X	<0.1		NA		0		4	ug/L				
19V. Ethylbenzene (100-41-4)	X		X	<0.1		NA		0		4	ug/L				
20V. Methyl Bromide (74-83-9)	X		X	<0.1		NA		0		4	ug/L				
21V. Methyl Chloride (74-87-3)	X		X	<0.1		NA		0		4	ug/L				

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)	X		X	<0.5		NA		0		4	ug/L				
23V. 1,1,2,2-Tetrachloroethane (79-34-5)	X		X	<0.1		NA		0		4	ug/L				
24V. Tetrachloro-ethylene (127-18-4)	X		X	<0.1		NA		0		4	ug/L				
25V. Toluene (108-88-3)	X		X	<0.1		NA		0		4	ug/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	X		X	<0.1		NA		0		4	ug/L				
27V. 1,1,1-Trichloro-ethane (71-55-6)	X		X	<0.1		NA		0		4	ug/L				
28V. 1,1,2-Trichloro-ethane (79-00-5)	X		X	<0.1		NA		0		4	ug/L				
29V Trichloro-ethylene (79-01-6)	X		X	<0.1		NA		0		4	ug/L				
30V. Trichloro-fluoromethane (75-69-4)			X	<0.1		NA		0		3	ug/L				
31V. Vinyl Chloride (75-01-4)	X		X	<0.1		NA		0		4	ug/L				
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	X		X	<0.1		NA		0		4	ug/L				
2A. 2,4-Dichloro-phenol (120-83-2)	X		X	<0.1		NA		0		4	ug/L				
3A. 2,4-Dimethyl-phenol (105-67-9)	X		X	<0.1		NA		0		4	ug/L				
4A. 4,6-Dinitro-O-Cresol (534-52-1)	X		X	<0.2		NA		0		4	ug/L				
5A. 2,4-Dinitro-phenol (51-28-5)	X		X	<0.2		NA		0		4	ug/L				
6A. 2-Nitrophenol (88-75-5)	X		X	0.54		NA		0.21		4	ug/L				
7A. 4-Nitrophenol (100-02-7)	X		X	1.56		NA		0.47		4	ug/L				
8A. P-Chloro-M-Cresol (59-50-7)	X		X	<0.1		NA		0		4	ug/L				
9A. Pentachloro-phenol (87-86-5)	X		X	<0.1		NA		0		4	ug/L				
10A. Phenol (108-95-2)	X		X	<0.1		NA		0		4	ug/L				
11A. 2,4,6-Trichloro-phenol (88-05-2)	X		X	<0.1		NA		0		4	ug/L				

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)	X		X	<0.1		NA		0		4	ug/L				
2B. Acenaphtylene (208-96-8)	X		X	<0.1		NA		0		4	ug/L				
3B. Anthracene (120-12-7)	X		X	<0.1		NA		0		4	ug/L				
4B. Benzidine (92-87-5)	X		X	<0.1		NA		0		4	ug/L				
5B. Benzo (*a*) Anthracene (56-55-3)	X		X	<0.1		NA		0		4	ug/L				
6B. Benzo (*a*) Pyrene (50-32-8)	X		X	<0.1		NA		0		4	ug/L				
7B. 3,4-Benzo-fluoranthene (205-99-2)	X		X	<0.1		NA		0		4	ug/L				
8B. Benzo (*ghi*) Perylene (191-24-2)	X		X	<0.1		NA		0		4	ug/L				
9B. Benzo (*k*) Fluoranthene (207-08-9)	X		X	<0.1		NA		0		4	ug/L				
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)	X		X	<0.1		NA		0		4	ug/L				
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)	X		X	<0.1		NA		0		4	ug/L				
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)	X		X	<0.1		NA		0		4	ug/L				
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)	X		X	2.16		NA		0.98		4	ug/L				
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	X		X	<0.1		NA		0		4	ug/L				
15B. Butyl Benzyl Phthalate (85-68-7)	X		X	<0.2		NA		0		4	ug/L				
16B. 2-Chloro-naphthalene (91-58-7)	X		X	<0.1		NA		0		4	ug/L				
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)	X		X	<0.1		NA		0		4	ug/L				
18B. Chrysene (218-01-9)	X		X	<0.1		NA		0		4	ug/L				
19B. Dibenzo (*a,h*) Anthracene (53-70-3)	X		X	<0.1		NA		0		4	ug/L				
20B. 1,2-Dichloro-benzene (95-50-1)	X		X	<0.1		NA		0		4	ug/L				
21B. 1,3-Di-chloro-benzene (541-73-1)	X		X	<0.1		NA		0		4	ug/L				

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)	X		X	<0.1		NA		0		4	ug/L				
23B. 3,3-Dichloro-benzidine (91-94-1)	X		X	<0.1		NA		0		4	ug/L				
24B. Diethyl Phthalate (84-66-2)	X		X	<0.2		NA		0		4	ug/L				
25B. Dimethyl Phthalate (131 -11-3)	X		X	<0.2		NA		0		4	ug/L				
26B. Di-N-Butyl Phthalate (84-74-2)	X		X	<0.2		NA		0		4	ug/L				
27B. 2,4-Dinitro-toluene (121-14-2)	X		X	<0.1		NA		0		4	ug/L				
28B. 2,6-Dinitro-toluene (606-20-2)	X		X	<0.1		NA		0		4	ug/L				
29B. Di-N-Octyl Phthalate (117-84-0)	X		X	<0.2		NA		0		4	ug/L				
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)	X		X	<0.1		NA		0		4	ug/L				
31B. Fluoranthene (206-44-0)	X		X	<0.1		NA		0		4	ug/L				
32B. Fluorene (86-73-7)	X		X	<0.1		NA		0		4	ug/L				
33B. Hexachloro-benzene (118-74-1)	X		X	<0.1		NA		0		4	ug/L				
34B. Hexachloro-butadiene (87-68-3)	X		X	<0.1		NA		0		4	ug/L				
35B. Hexachloro-cyclopentadiene (77-47-4)	X		X	<0.1		NA		0		4	ug/L				
36B Hexachloro-ethane (67-72-1)	X		X	<0.1		NA		0		4	ug/L				
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X		X	<0.1		NA		0		4	ug/L				
38B. Isophorone (78-59-1)	X		X	<0.1		NA		0		4	ug/L				
39B. Naphthalene (91-20-3)	X		X	<0.1		NA		0		4	ug/L				
40B. Nitrobenzene (98-95-3)	X		X	<0.1		NA		0		4	ug/L				
41B. N-Nitro-sodimethylamine (62-75-9)	X		X	<0.1		NA		0		4	ug/L				
42B. N-Nitrosodi-N-Propylamine (621-64-7)	X		X	<0.1		NA		0		4	ug/L				

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)	X		X	<0.1		NA		0		4	ug/L				
44B. Phenanthrene (85-01-8)	X		X	<0.1		NA		0		4	ug/L				
45B. Pyrene (129-00-0)	X		X	<0.1		NA		0		4	ug/L				
46B. 1,2,4-Tri-chlorobenzene (120-82-1)	X		X	<0.1		NA		0		4	ug/L				
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α-BHC (319-84-6)			X												
3P. β-BHC (319-85-7)			X												
4P. γ-BHC (58-89-9)			X												
5P. δ-BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α-Enosulfan (115-29-7)			X												
12P. β-Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

CONTINUE ON PAGE V-9

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
WAD980738488	001

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

Table II.B (continued)

1. OUT-FALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
NA (g)	Building Roof Drains	0.002 MGD	Intermittent stormwater collection	1-F	
		(estimate)	in double-lined evaporation ponds		
			To be determined sediment disposal location	5-Q	
NA (h)	HVAC Airwash Drains	0.006 MGD	Seasonal collection in double-lined	1-F	
		(estimate)	evaporation ponds		
NA (i)	Sanitary Waste	0.010 MGD	Aerated lagoons	3-B	
			Stabilization ponds	3-G	1-F
			Intermittent discharge to percolation beds	3-F	
NA (j)	Fire Protection System	0.003 MGD	Intermittent discharge to soil	3-F	
	Flushes, & other misc.	(estimate)			
	Hydrotesting, Maintenance				
	and Construction Activities				

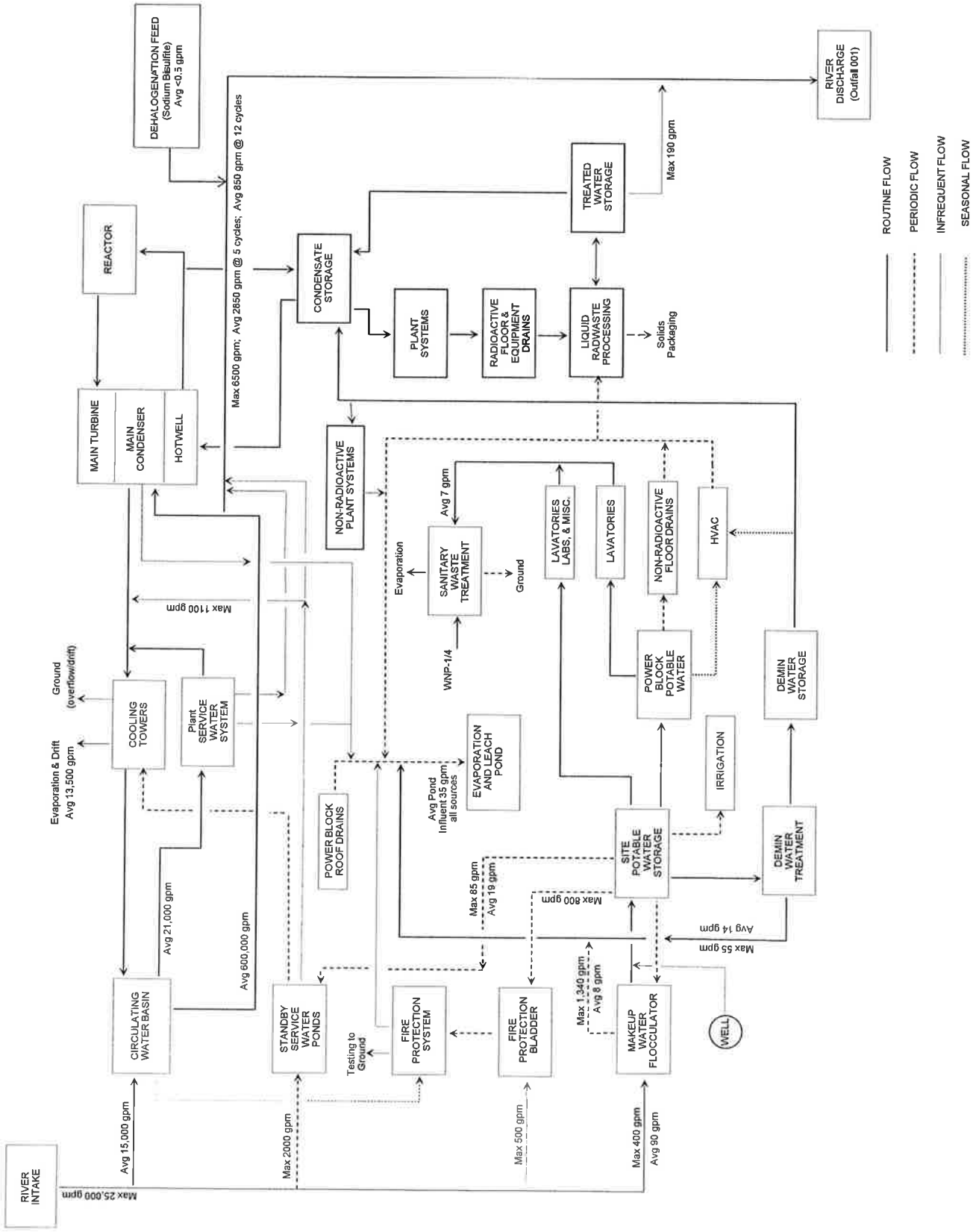
Table II.C

1. OUTFALL NUMBER (*list*)	2. OPERATION(*s*) CONTRIBUTING FLOW (*list*)	3. FREQUENCY		4. FLOW				
		a. DAYS PER WEEK (*specify average*)	b. MONTHS PER YEAR (*specify average*)	a. FLOW RATE (*in mgd*)		B. TOTAL VOLUME (*specify with units*)		C. DURATION (*in days*)
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	
001	Radioactive Waste Treatment System Effluent	No discharge during permit period	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	NA
001	Standby Service Water	No discharge during permit period	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	NA
Evaporation Ponds	Potable Water Treatment	5	12	0.011	0.201	11,000 gal	201,000 gal	<1
Evaporation Ponds	Nonrad Plant Equipment	1	4	<0.002 (estimate)	0.3 (estimate)	2000 gal (estimate)	300,000 gal	<1
Evaporation Ponds	HVAC Airwash	7	7	0.006 (estimate)	0.007 (estimate)	6000 gal (estimate)	7000 gal (estimate)	1
NA	Fire Protection System Flushed, & other misc. Hydrotesting, Maintenance, and Construction Activities	1	9	<0.001 (estimate)	0.015 (estimate)	1000 gal (estimate)	15,000 gal (estimate)	<1

Section IV. IMPROVEMENTS B. Optional

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT
	a. NO.	b. SOURCE OF DISCHARGE	
Permit modification request dated 10/9/2018 for dehalogenation system	001	Circulating Cooling Water Blowdown	The modification will add a continuous halogenation with a dehalogenation system to the existing batch halogenation process. Anticipated implementation summer 2019.

Attachment to Form 2C, Item II.A
CGS Flow Diagram



WASTEWATER SOURCE DESCRIPTIONS

Columbia Generating Station (CGS)
April 2019

Circulating Cooling Water Blowdown

The main steam condenser and miscellaneous heat exchangers (plant service water system) are cooled by the non-contact circulating water (CW) system. The recirculating flow is typically about 600,000 gallons per minute (gpm). The heat is rejected to the atmosphere by the evaporative process in six (6) mechanical draft cooling towers. The evaporated water and that lost through drift and blowdown is replenished from the Columbia River at an average rate of about 15,000 gpm. Evaporation of the cooling water results in the concentration of dissolved solids. To limit the buildup of dissolved salts, a portion of the cooling water is released to the river as blowdown (to Outfall 001).

Although the blowdown stream is intended to be a relatively constant discharge, several factors can cause variation in the chemical composition of the discharge. The most important factor is the adjustable blowdown rate that determines the concentration factor for dissolved material in the circulating water. Columbia Generating Station (CGS) has typically operated between 5 cycles of concentration (about 2,850 gpm blowdown) and 12 cycles of concentration (about 850 gpm blowdown).

The chemical composition of the blowdown is also affected by the circulating water treatment regime. Sulfuric acid is added to help maintain pH in the range of 8.2 to 8.6 for optimal reduction of biofouling and scale. The water is also treated with DVS3A002 which is a HEDP (1 hydroxy-ethylidne-1, 1, diphosphonate) and AMPs (amino-trimethylene-phosphonate) copolymer blend that functions as a calcium scale inhibitor and a dispersant. Sodium tolyltriazole, which is a halogen-resistant azole (HRA), is added separately for copper alloy corrosion control.

On March 19, 2019 EFSEC modified CGS' NPDES permit to improve the inhibition of biological fouling of the circulating water and plant service water systems. This improvement involves changing from a batch to a continuous halogenation process, with continuous injection of the same halogenation agents (sodium hypochlorite and sodium bromide). CGS will add two additional chemicals to assist the effectiveness of the halogenation, a biodispersant (surfactant) and an antifoaming agent. To prevent the discharge of elevated halogen (i.e., chlorine and bromine derivatives) to Outfall 001, the dehalogenation agent sodium bisulfite will be continuously added to the blowdown in a controlled manner.

The current batch process for microbiocidal treatment will be retained as a backup procedure in the event of a problem with the effluent total residual halogen (TRH) analyzer or other problem with the continuous halogenation/dehalogenation system. The batch microbiocidal process involves additions of sodium hypochlorite and sodium bromide two or three times per

week. Upsets in these batch treatments can result in variations in the amount of plant component material that becomes corroded or eroded into the cooling water. Also, concentrations of dissolved material can increase slightly during batch biocide treatment because blowdown is terminated for approximately 10 to 24 hours to allow the halogen residual to decay.

Another factor causing short-term increases in metal concentrations in the cooling water is the periodic dewatering and mechanical cleaning of the condenser tubes during maintenance outages. Online cooling tower cleaning to remove silt and organic matter can cause some of the material to become re-suspended such that the solids concentration in the blowdowm is slightly higher than normal. CW (and blowdown) suspended solids concentrations are also increased during dust storms because the towers act like large air scrubbers. Seasonal increase in makeup water turbidity also results in higher CW suspended solids.

Also affecting the composition of the waste stream at point of entry to the river are the streams that may be introduced into the blowdown line. One of these is processed liquid radwaste which is relatively pure, low conductivity water that is released in batches of about 15,000 gallons at rates of up to 190 gpm. These releases are necessary if the plant storage inventory is full or if the total organic content of the water is too high to be used in the plant. There have been no releases from the liquid radwaste system since September 19, 1998.

During Plant Service Water (TSW) system outages approximately 110,000 of TSW water is drained via the blowdown line. The TSW system maintenance is infrequent and occurs approximately every ten years.

Another source of water discharged to the blowdown line is the standby service water (SSW) system (discussed in more detail in the SSW section below). The primary reason for discharging service water is to reduce the concentration of sulfur or chlorides that have the potential to induce corrosion. Other reasons for discharging include the need to perform maintenance on the submerged components in the spray ponds, the need to clean out accumulations of sediments in the ponds, or to reduce suspended solids in the ponds. Infrequently, several million gallons of standby service water might be released to the blowdown line or to the CW system over a period of a couple days to multiple weeks. This water tends to be of lower cycles of concentration than the circulating cooling water.

Periodically the main condenser becomes scaled, reducing plant efficiency to the point that chemical cleaning of the main condenser becomes necessary. Blowdown to the river will be secured and a cleaning agent, Ferroquest™ or equivalent, will be added to the circulating water system. Sodium tolyltriazole will be added for copper metal corrosion protection. After the treated water has circulated a sufficient time to remove most of the scale (estimated to be one or two hours), sodium hydroxide will be added for pH adjustment. At the completion of the cleaning process, if any permit condition is not met, circulating water will be pumped to a storage location using temporary pumps and piping. During this pumping process, the concentration of constituents in the circulating water will be reduced by the addition of

makeup water from the river. When the circulating water meets all conditions for discharge, blowdown to the river will be initiated. After the condenser cleaning process is completed, the stored water will be treated as necessary to meet discharge requirements. Following achievement of discharge limits, the water will be pumped back to the circulating water basin at Columbia Generating Station. Sediment from the cleaning process will be analyzed and disposed in accordance with our solid waste control plan.

Stormwater and Miscellaneous Wastes

Runoff from the power block building roofs is routed through the stormwater system to Evaporation Ponds 3 and 4 located approximately 1500 feet northeast of the plant. Stormwater collected in the bermed area around the Diesel Fuel Polishing Building is collected in a sump and periodically discharged to Evaporation Ponds 3 and 4.

Also routed to the Evaporation Ponds are several wastewater streams. The most significant non-rainfall sources are the water treatment systems. Site potable water is prepared by flocculation and filtration of river water. The mixed media filter is periodically cleaned by backwashing with approximately 12,000-33,000 gallons of potable water. This backwash water is discharged through the storm drain system. A side stream of potable water is provided with additional treatment to produce high purity plant process water. The demineralized water treatment system consists of a reverse osmosis unit and has a maximum reject stream of about 55 gpm and an average reject stream of approximately 14 gpm, when it is producing water, with a feed flow rate of 70 gpm. It also has continuous 5 gpm flow through monitoring instrumentation. Both of these streams are routed to Evaporation Ponds 1A, 1B and 2.

Other sources of water discharges to Evaporation Ponds 3 and 4 are the sump in the plant General Services Bldg (GSB) basement and floor drains in the Diesel-Generator Bldg (DGB). The GSB sump collects water from building equipment drains and area floor drains. Examples of water sources directed to the sump include HVAC units, pump and valve leakage, demineralized water storage tank overflows, and floor washings. A level switch activates the sump pump and causes the collected water to be discharge to the Evaporation Ponds. The DGB floor drains are connected directly to the stormwater pipe. Among the few sources of water in the DGB are the diesel engine cooling jackets from which approximately 3,800 gallons of water treated with a nitrite-based corrosion inhibitor are drained about once per year.

The Turbine-Generator Bldg (TGB) has three non-radioactive sumps that are directed to radwaste processing. The sumps are receiving points for equipment and floor drains in the TGB. The sumps are no longer physically connected to the storm drainage system. The Radwaste and Reactor buildings have air wash units on the fresh air intakes that operate during warm weather months and discharge to Evaporation Ponds 3 and 4.

Operation and testing of the fire protection system is another source of water discharges to the Evaporation Ponds. Periodically portions of the system are removed from service for flushing and flow-rate tests. These batches or several thousand gallons may also be routed to the

sanitary waste system or directly to the ground depending on the location and system configuration.

Other discharges to ground may include hydrotesting, maintenance, and construction wastewater discharges. Hydrotesting discharges such as system and component testing, maintenance discharges such as drainage, flushing, and wash down activities, and construction discharges such as compaction, demolition, vacuum truck digging, dust control watering, concrete curing, concrete cutting, including rinsate and etching solutions, and pressure washing activities. Additionally, discharges to ground may also include condensate discharges from heating, ventilation, and air conditioning systems, air compressors, and engines; potable water system testing and flushing, water tank overflows; other miscellaneous discharges such as well sampling purge water, eyewash and safety shower testing, and incidental releases from facilities.

Stormwater runoff from parking lots, support buildings, and other impervious surfaces around CGS are managed by multiple underground injection control (UIC) wells.

Standby Service Water

The SSW system removes reactor decay heat during normal shutdown conditions and provides a heat sink for emergency equipment during a plant transient or accident. The SSW system is a closed-loop circulating water system that draws cooling water from, and returns heated water to an onsite reservoir. This reservoir consists of an interconnected pair of concrete basins (or spray ponds) with a total capacity of 12 million gallons. Water lost to evaporation, drift, and discharges is replenished from the river or from the site potable water system. Dissolved constituents in the SSW are typically 2½ times river concentrations. Microbiological growth is currently controlled with periodic batch additions of 50% hydrogen peroxide. In the past, Busan 77 has been used to control microbiological growth and may be used in the future. The service water is also treated with sodium silicate for corrosion inhibition.

On an infrequent basis, the SSW ponds must be drained down for cleaning or for equipment maintenance. Sediments can also be vacuumed from the bottom of the ponds without draining the ponds. The sediments removed from the ponds are placed in the sediment disposal cells in accordance with EFSEC Resolution No. 299. As discussed above, the ponds can also be dewatered by direct discharge to the blowdown line (Outfall 001) or routed to the CW system.

Sanitary Waste

Sanitary waste from CGS, WNP-1/4, and the support facilities is piped to a treatment system that uses aeration lagoons and facultative stabilization ponds. This wastewater treatment facility is located about ½ mile southeast of CGS. Influent averages about 10,000 gallons per day with the higher flows being coincident with the biannual CGS maintenance outage. When the stabilization ponds are full, the treated wastewater is discharged to percolation beds. These discharges occur once every few years in accordance with EFSEC Resolution No. 300. In

2018 CGS submitted a Waste Discharge Permit application to EFSEC to supersede Resolution No. 300.

Chemical Usage

Water treatment additives used in the systems discussed above and in other water systems is summarized in the attached table.

Columbia Generating Station Chemical Usage

System and Chemical	Frequency	Annual Use (lb/year)		Description of Use
		Average	Maximum	
Circulating Water/Plant Service Water				
Sulfuric Acid (93% Electrolyte)	Continuous	2,500,000	2,700,000	pH control
Sodium Hypochlorite (10-16%)	Continuous or Batch ~2-3 times/wk	940,000	1,100,000	Biocide
Sodium Bromide	Continuous or Batch ~2-3 times/wk	340,000	360,000	Biocide
AMPs Copolymer & Polyphosphate Blend (DVS3A002)	Continuous	230,000	250,000	Dispersant and Corrosion Control
Sodium Tolyltriazole – 50% (CWT4543)	Periodic	40,000	40,000	Corrosion Control
Ferroquest ™	Periodic	As needed[1]	140,000	Condenser Cleaning
Sodium Hydroxide (>95%)	Periodic	As needed[1]	13,000	pH control following chemical cleaning
Spectrus BD1500	Continuous	30,000	45,000	Biodispersant (surfactant)
Foamtrol AF1090	Continuous	13,000	25,000	Antifoaming Agent
Spectrus DT1404 (sodium bisulfite)	Continuous	92,000	150,000	Dehalogenation Agent
Standby Service Water				
Hydrogen Peroxide (50%)	Batch – seasonal	490,000	510,000	Biocide
Busan 77	Batch - Seasonal	10,000	22,000	Biocide
N Sodium Silicate	Batch	35,000	70,000	Corrosion Control
Potable Water				
Sodium Hypochlorite (10-16%)	Semi-continuous	9,400	16,000	Disinfectant
Poly Aluminum Chloride	Continuous	4000	4100	Coagulant Aid
Polymer	Continuous	6	6	Filter Aid
Demineralized Water				
Amino Acid F	Semi-continuous	76	80	Silica Analyzer Reagent
Citric Acid/Surfactant Reagent	Semi-continuous	82	85	Silica Analyzer Reagent
Molybdate 3 Reagent	Semi-continuous	91	100	Silica Analyzer Reagent
Silica Standard Solution	Semi-continuous	76	80	Silica Analyzer Reagent
Closed Cooling Loops				
Nalco 39M	Batch as required	1100	2800	Corrosion Inhibition – Diesel Jacket Water
Sodium Nitrite	Batch as required	As needed[1]	As needed	Corrosion Inhibition – HVAC Chiller & Heater Systems
Sodium Hydroxide	Batch as required	As needed[1]	As needed	pH Control – HVAC Chiller & Heater Systems
Standby Liquid Control				
Enriched Sodium Pentaborate	Batch as required	110	400	Reactivity Control (Backup)

[1] Chemicals used on an "As Needed" basis do not have routine or scheduled usage determined by procedures

ENCLOSURE B

CHRONIC TOXICITY TEST RESULTS

BIOASSAY REPORT

CHRONIC
BIOASSAYS CONDUCTED
January 30 through February 6, 2018
and February 27 through March 6, 2018

Prepared for

ENERGY NORTHWEST
RICHLAND, WASHINGTON

Prepared by

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
ASL

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NELAC #OR100022
State of Washington Department of Ecology (WDOE), Lab ID C1233
California State Environmental Laboratory Accreditation Program, Certificate No.: 1726

Report Date: March 20, 2018
Lab I.D. Nos. B3934-ch and B3954

CONTENTS

INTRODUCTION

TestAmerica ASL (TA-ASL) – Bioassay Laboratory conducted chronic bioassays using the *Pimephales promelas* (fathead minnow) and the water flea (*Ceriodaphnia dubia*), on samples provided by Energy Northwest, Richland, Washington. The tests were conducted from January 30 through February 6, 2018.

Due to high Percent Minimum Significant Differences (PMSD) values above the upper bounds listed in the protocol, the *C. dubia* chronic testing initiated on January 30 was deemed "not reliable" as per USEPA guidance. The *C. dubia* chronic test was successfully repeated using freshly collected samples from February 27 through March 6, 2018. All data is summarized below.

Note: Acute testing using the *Pimephales promelas* (fathead minnow) was also initiated during this time. As per client request, the acute results will be reported separately.

OVERVIEW OF REGULATORY GUIDANCE

The following provides an overview and excerpts of applicable permit specifics, regulatory guidance, and other relevant information. This is intended only as a helpful guide, from a laboratory perspective, for understanding test outcomes. The final responsibility for interpretation of results remains with the client and/or regulatory agency.

The following guidance is taken from TA-ASL's reading of the NPDES permit for Energy Northwest's Columbia Generating Station in Richland, WA (permit #WA002515-1, effective Nov 1, 2014, expires Oct 31, 2019, modified Feb 8, 2016).

Chronic toxicity:

Testing:

- "Conduct chronic toxicity testing … once per quarter in the year prior to submission of the application for permit renewal."
- "The CCEC equals 1% effluent."

The following is taken from the WDOE guidance (WQ-R-95-80, June 2016 revision):

> "To reduce WET limit violations (and anomalous concentration-response relationships) due to statistical significance that is a Type I error [false positive], we lower alpha when differences in test organism response are small."
> "Alpha will be lowered from 0.05 to 0.01 if a … 20% difference in a chronic test is significant."

SUMMARY OF TEST RESULTS

Exhibit 1 provides a summary of the final test results.

EXHIBIT 1
Summary of Chronic Test Results

Species	NOEC (%)	LOEC (%)	IC_{25} (%)
C. dubia (Jan 30)	33.0 [a]	100 [a]	< 1 [a]
C. dubia (Feb 27)	11.0	33.0	35.1
P. promelas (Jan 30)	100	> 100	> 100

[a] Indicates the upper PMSD bound was exceeded indicating unusually high and unacceptable amounts of variability in the test. USEPA guidance states that this testing should be repeated.
Note: acronyms are as defined below.

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

More detailed information is provided in the Results and Discussion section.

ACRONYM DEFINITIONS (from EPA guidance):

NOEC = No Observed Effect Concentration: The highest test concentration that causes no observable adverse effects on the test organisms (i.e. no statistically significant reduction from the control).
LOEC = Low Observed Effect Concentration: The lowest test concentration that does cause an observable adverse effect on the test organisms (i.e. is statistically significant reduction from the control).
IC_{25} = Inhibition Concentration (25%): A point estimate of the test concentration that would cause a 25 percent reduction of a non-quantal biological measurement (i.e. growth, reproduction, etc.) for the test population.

SAMPLE INFORMATION

Exhibit 2 provides a summary of the sample conditions as received.

EXHIBIT 2
Sample Conditions on Receipt

Sample ID			
TA-ASL SDG + suffix	B3934 -01	B3934 -02	B3934 -03
Collection - Date and Time	01/29/2018 05:05	01/31/2018 05:00	02/02/2018 05:10
Receipt - Date and Time	01/30/2018 10:15	02/01/2018 10:00	02/03/2018 09:25
Temperature (^{o}C)	0.6	0.7	0.6
Dissolved Oxygen (mg/L)	12.1	11.8	11.4
pH	8.3	8.2	8.2
Conductivity (S/cm)	1422	1390	1434
Total Residual Chlorine (mg/L)	< 0.02	0.03 [a]	< 0.02
Ammonia (mg/L as NH_3-N)	< 0.10	< 0.10	< 0.10
Total Hardness (mg/L as $CaCO_3$)	814	813	848
Total Alkalinity (mg/L as $CaCO_3$)	134	138	138

[a] Indicates the observed total Residual Chlorine reading did not reduce with sodium thiosulfate addition. Observed reading may be due to an interferent.

Exhibit 3 provides a summary of the sample conditions as received for the retest.

EXHIBIT 3
Sample Conditions on Receipt

Sample ID			
TA-ASL SDG + suffix	B3954 -01	-02	-03
Collection - Date and Time	02/26/2018 05:30	02/28/2018 05:27	03/02/2018 05:29
Receipt - Date and Time	02/27/2018 11:15	03/01/2018 10:30	03/03/2018 09:15
Temperature (^{o}C)	3.1	0.3	1.1
Dissolved Oxygen (mg/L)	8.2	8.9	8.0
pH	7.4	7.5	8.3
Conductivity (S/cm)	1330	1350	1392
Total Residual Chlorine (mg/L)	0.04 [a]	0.03 [a]	< 0.02
Ammonia (mg/L as NH_3-N)	< 0.10	< 0.10	< 0.10
Total Hardness (mg/L as $CaCO_3$)	738	766	752
Total Alkalinity (mg/L as $CaCO_3$)	114	118	118

[a] Indicates the observed total Residual Chlorine reading did not completely reduce with sodium thiosulfate addition. Observed reading may be due to an interferent.

Water quality measurements during testing remained within test design limits as prescribed by EPA and WDOE, except as noted with the individual test results. (see the Results and Discussion section)

METHODS AND MATERIALS

TEST METHODS

The chronic test methods were performed according to: *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, (2002), EPA-821-R-02-013.

Additional guidance was provided by:

Whole Effluent Toxicity Testing Guidance and Test Review Criteria, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

DEVIATIONS FROM PROTOCOLS

Deviations from required procedures in the test methods:

None noted.

Deviations from recommended procedures in the test methods:

EPA-821-R-02-013, Section 10.2.8 discusses test variability. Specifically, use of Percent Minimum Significant Differences (PMSD) limits is discussed.

When the test PMSD exceeds the upper bound, the variability among replicates is unusually large for the test method.

When the PMSD exceeds the upper bound and no toxicity is found at the level of regulatory concern, then the "no toxicity" result should not be considered reliable and the test rerun.

This is the case for the *C. dubia* chronic test initiated on January 30, 2018.

The *C. dubia* chronic retest initiated on February 27, 2018, showed PMSD values below the upper bound (not a deviation).

The pH meter calibration on Jan. 30, 2018 showed a slope value out of the recommended specification. Second source check was within tolerance. Therefore all pH measurements collected on Jan. 30, 2018 have been flagged with a "R30" QA code and while likely accurate, should be interpreted with care.

TEST DESIGN

The following summarizes the conditions used for both overall testing and the specifics for each test (observations and notations can be found on the datasheets in Appendix A):

Overall Test Design:

Chronic tests: 1.0, 3.3, 11.0, 33.0, and 100 percent sample + dilution water for the control.

Test Organism Conditions:

All organisms tested were fed and maintained during culturing, acclimation, and testing as prescribed by the EPA (2002).

The test organisms appeared vigorous and in good condition prior to testing.

C. dubia chronic test:

Source: TA-ASL's in-house cultures

Age: Less than 24 hours old and within an 8-hour age range, with blocking by known parentage

Design: Ten test vessels per concentration, one organism per vessel

Test Solution Renewal: Daily

Monitoring:

- Daily: Survival and neonate production (with brood determination)
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination:

- Survival: @ after 7 days.
- Reproduction: When 60%+ of surviving control organisms produce a 3rd brood.

Endpoints: Survival (at termination) and Reproduction (through first 3 broods)

P. promelas chronic test:

Source: Aquatox Inc., Hot Springs, Arkansas

Age: Less than 48 hours old and within an 24 hour age range

Design: Four test vessels per concentration, ten organisms per vessel

Test Solution Renewal: Daily

Monitoring:

- Daily: Survival
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination: 7 days after test initiation.

Endpoints: Survival and Growth (average dry weight per organism added @ initiation)

DILUTION WATER

The dilution water used was the standard culture water used by TA-ASL:

Reconstituted, moderately hard water (as per EPA protocol) with a total hardness of 80 to 100 mg/L as $CaCO_3$ and an alkalinity of 60 to 70 mg/L as $CaCO_3$.

SAMPLE COLLECTION AND STORAGE

Samples were collected by Energy Northwest personnel. The samples were accepted as scheduled by TA-ASL. Chain of Custody and Sample Receipt Records are provided in Appendix C.

All samples were received within the EPA recommended 0 to 6 °C range.
All samples were received within the WDOE required 0 to 6 °C range.
All samples were initially used for test initiation or test solution renewal within the EPA recommended maximum holding time of 36 hours of sample collection.
All subsequent uses of a sample occurred within the EPA recommended maximum holding time of 72 hours past the time of initial use of that sample.
All subsequent uses of a sample occurred within the WDOE recommended maximum holding time of 72 hours past the time of sample collection.
Following receipt, the samples were stored in the dark at 0 to 6 C until test solutions were prepared and tested.

SAMPLE PREPARATION

Samples used during these tests were:

Temperature adjusted prior to test initiation and each daily renewal.
Dechlorination with sodium thiosulfate was performed.

DATA ANALYSIS

The statistical analyses performed for the chronic tests were those outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, USEPA Office of Water, Fourth Edition (EPA 2002), EPA-821-R-02-013, using CETIS.

Additional guidance was provided by *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

The specific statistical analysis and CETIS version used for each endpoint evaluation is listed with the statistical outputs included with each test in Appendix A.
If any additional analysis methods were also used, an explanation of the rationale and reference to the source method is included with the presentation of those results below.

RESULTS AND DISCUSSION

The raw data sheets are presented in Appendix A.

CHRONIC BIOASSAYS

Table 1 summarizes the survival and reproduction data for the *C. dubia* chronic test initiated on January 30, 2018.

Table 1
Summary of Chronic Results
C. dubia

Sample Concentration (%)	Percent Survival	Mean Number of Young Per Adult
Control	90	19.0
1.0	80	13.2
3.3	70	12.6
11.0	80	13.2
33.0	80	10.9
100	70	2.9 [a]

[a] Indicates a statistically significant difference from the control at alpha = 0.05.

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 33.0 %
LOEC = 100 %
IC_{25} < 1.00 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

EPA-821-R-02-013, Section 10.2.8 discusses test variability. Specifically, use of Percent Minimum Significant Differences (PMSD) limits is discussed.

> When the test PMSD exceeds the upper bound, the variability among replicates is unusually large for the test method.
>
> When the PMSD exceeds the upper bound and no toxicity is found at the level of regulatory concern, then the "no toxicity" result should not be considered reliable and the test rerun.
>
> This is the case for the *C. dubia* chronic test initiated on January 30, 2018.

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *C. dubia* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum 15 young produced per surviving control adult. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. However, due to the unacceptably high PMSD value, this testing should be considered "anomalous".

Table 2 summarizes the survival and reproduction data for the *C. dubia* chronic retest initiated on February 27, 2018.

Table 2
Summary of Chronic Results
C. dubia

Sample Concentration (%)	Percent Survival	Mean Number of Young Per Adult
Control	90	30.5
1.0	100	31.1
3.3	100	31.4
11.0	100	33.3
33.0	100	24.8 [a]
100	60	4.0 [a]

[a] Indicates a statistically significant difference from the control at alpha = 0.05.

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 11.0 %
LOEC = 33.0 %
IC_{25} = 35.1 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *C. dubia* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum 15 young produced per surviving control adult. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

Table 3 summarizes the survival and growth data for the *P. promelas* chronic test initiated on January 30, 2018.

Table 3
Summary of Chronic Results
P. promelas

Sample Concentration (%)	Percent Survival	Mean Dry Weight Per Organism Added (mg)
Control	100	0.784
1.0	92.5	0.702
3.3	97.5	0.738
11.0	100	0.766
33.0	95.0	0.796
100	100	0.868

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 100 %
LOEC > 100 %
IC_{25} > 100 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *P. promelas* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum weight of 0.250 mg per surviving control organism. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

REFERENCE TOXICANT TESTS

Reference toxicant (reftox) testing is performed to document both initial and ongoing laboratory performance of the test method(s). While the health of the test organisms is primarily evaluated by the performance of the laboratory control, reftox test results also may be used to assess the health and sensitivity of the test organisms. Reftox test results within their respective cumulative summary (Cusum) chart limits are indicative of consistent laboratory performance and normal test organism sensitivity.

The results of the reftox tests indicate that the test organisms were within their respective cusum chart limits based on EPA guidelines. This demonstrates ongoing laboratory proficiency of the test methods and suggests normal test organism sensitivity in the associated client testing.

The *C. dubia* chronic reftox test was conducted using sodium chloride. The *P. promelas* chronic reftox test was conducted using potassium chloride. The data sheets for the reference toxicant tests are provided in Appendix B.

Table 4 summarizes the reference toxicant test results and Cusum chart limits.

Table 4
Chronic Reference Toxicant Tests (g/L)

Species	IC_{25}	Cusum Chart Limits
C. dubia (survival) - January	1.67	1.08 to 2.36
C. dubia (reproduction) - January	0.58	0.26 to 1.33
C. dubia (survival) - February	1.68	1.06 to 2.37
C. dubia (reproduction) - February	0.68	0.16 to 1.33
P. promelas (survival)	0.62	0.56 to 0.64
P. promelas (growth)	0.57	0.44 to 0.72

APPENDIX A

RAW DATA SHEETS

TestAmerica

FRESHWATER TOXICITY TEST: SAMPLE AND DILUTION WATER DATA

Client: Energy Northwest — SDG # B 3934 — Test Initiation: Date 1-30-2018

Contact: Jane LaPage (509) 377-4061 — Test Termination: Date 2-6-2018

Sample ID Number	Field ID	Collected Date (mm/dd/yy)	Collected Time (Pacific Zone)	Received Date (mm/dd/yy)	Received Time (Pacific Zone)	Temp (°C) as Rc'vd	Total Residual Chlorine (mg/l) ☑ Dechlorination allowed as Rc'vd / after Dechlor.	Ammonia NH_3-N mg/l as Rc'vd	Hardness mg/l as $CaCO_3$ as Rc'vd	Alkalinity mg/l as $CaCO_3$ as Rc'vd	DO (mg/L) as Rc'vd	pH as Rc'vd	Cond. (uS) as Rc'vd	60 um filtered? (organisms noted)
B3934 -01	180787-01	01/29/18	05:05	1/30/18	10:15	0.6	<0.02 / —	<0.10	814	134	12.1	8.3	1422	☐
-02	180787-02	1/31/18	05:00	2/1/18	10:00	0.7	0.03 / 0.03	<0.10	813	138	11.8	8.2	1390	☐
-03	180787-03	2/2/18	05:10	2/3/18	9:25	0.6	<0.02 / —	<0.10	848	138	11.4	8.2	1434	☐
							/							
							/							
							/							
							/							
							/							
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							/							
							/							
							/							
							/							
Reporting Limits:						na	0.02 mg/L	0.10 mg/L	5 mg/L	5 mg/L	na	na	na	na

Note: "–" Indicates data collection or dechlorination not needed. Any other adjustments to samples prior to use are documented in Comments below or on Dilutions page.

Dilution Water	ID#	Hardness mg/l as $CaCO_3$	Alkalinity mg/l as $CaCO_3$
Recon MH (FHM)	4608	84	66
	4609	94	68
	4612	94	70
	4610	90	66

Comments: ☑ Indicates the action was taken, (☐= action not taken): " – " = sample not dechlorinated, or analyte not collected/needed.

☑ Dechlorination is **REQUIRED** if Total Residual Chlorine (TRC) is detected (i.e. TRC is 0.02 mg/L or greater).

From EPA manual (EPA-821-R-02-013, 8.8.7): 0.025 ml of a 26.8 g/L stock of sodium thiosulfate will reduce 0.10 mg/L TRC in a 1L sample.

(for example: 4L of sample at **0.10** mg/L TRC needs **0.10** ml of 26.8g/L sodium thiosulfate stock to be dechlorinated)

.01 sample Calc: (20 L sample) x (0.03 mg/L TRC) x 0.25 = 0.15 ml of 26.8 g/L sodium thiosulfate to add (ID: ZB065-07)

DO NOT add more sodium thiosulfate if "after Dechlor" TRC reading is not reduced to < 0.02 mg/L. Leave as is.

*Note in final report that the pH meter slope for 1-30-18 was out of range! DW=1-31-18

Water Quality Meters Used/ID#: Dissolved Oxygen # 4 pH # 11 Conductivity # 2

TestAmerica

FRESHWATER TOXICITY TEST: SAMPLE AND DILUTION WATER DATA

Client: Energy Northwest — SDG # B 3954 — Test Initiation: Date 2-27-18

Contact: Jane LaPage (509) 377-4061 — Test Termination: Date 3-6-2018

Sample ID Number	Field ID	Collected Date (mm/dd/yy)	Collected Time (Pacific Zone)	Received Date (mm/dd/yy)	Received Time (Pacific Zone)	Temp (°C) as Rc'vd	Total Residual Chlorine (mg/l) ☑ Dechlorination allowed as Rc'vd / after Dechlor.	Ammonia NH_3-N mg/l as Rc'vd	Hardness mg/l as $CaCO_3$ as Rc'vd	Alkalinity mg/l as $CaCO_3$ as Rc'vd	DO (mg/L) as Rc'vd	pH as Rc'vd	Cond. (uS) as Rc'vd	60 um filtered? (organisms noted)
B3954 -01	180871-01	2/26/18	05:30	2/27/18	11:15	3.1	0.04 / 0.02	<0.10	738	114	8.2	7.4	1330	☐
B3954 -02	180871-02	2/28/18	05:28	3/1/18	10:30	0.3	0.03 / 0.02	<0.10	766	118	8.9	7.5	1350	☐
-03	180871-03	3/2/18	05:29	3/3/18	09:15	1.1	<0.02 / —	<0.10	752	118	8.0	8.3	1392	☐
							/							
							/							
							/							
							/							
							/							
							/							
							/							
							/							
							/							
							/							
			Reporting Limits:			na	0.02 mg/L	0.10 mg/L	5 mg/L	5 mg/L	na	na	na	na

Note: "–" Indicates data collection or dechlorination not needed. Any other adjustments to samples prior to use are documented in Comments below or on Dilutions page.

Dilution Water	ID#	Hardness mg/l as $CaCO_3$	Alkalinity mg/l as $CaCO_3$
Recon MH (FHM)	4620	92	69
↓	4624	98	70
↓	4622	90	61

Comments: ☑ Indicates the action was taken, (☐= action not taken): " – " = sample not dechlorinated, or analyte not collected/needed.

☑ Dechlorination is **REQUIRED** if Total Residual Chlorine (TRC) is detected (i.e. TRC is 0.02 mg/L or greater).

From EPA manual (EPA-821-R-02-013, 8.8.7): 0.025 ml of a 26.8 g/L stock of sodium thiosulfate will reduce 0.10 mg/L TRC in a 1L sample.

(for example: **4L** of sample at **0.10** mg/L TRC needs **0.10** ml of 26.8g/L sodium thiosulfate stock to be dechlorinated)

-01 sample Calc: (4.25 L sample) x (0.04 mg/L TRC) x 0.25 = 0.0425 ml of 26.8 g/L sodium thiosulfate to add (ID: 28065-07)

-02 sample Calc: (4.28 L sample) x (0.03 mg/L TRC) x 0.25 = 0.0321 ml of 26.8 g/L sodium thiosulfate to add (ID: 28065-07)

-03 sample Calc: (____ L sample) x (____ mg/L TRC) x 0.25 = ____ ml of 26.8 g/L sodium thiosulfate to add (ID: ____)

DO NOT add more sodium thiosulfate if "after Dechlor" TRC reading is not reduced to < 0.02 mg/L. Leave as is.

Water Quality Meters Used/ID#: Dissolved Oxygen #4 pH #11 Conductivity #2

TestAmerica

FRESHWATER TOXICITY TEST: TEST ORGANISM INFORMATION

Client: Energy Northwest Sample Designation (SDG): B 3934

Test Species Information	Cd # 3394 *Ceriodaphnia dubia* Chronic	FHM # 1965 *Pimephales promelas* Chronic	FHM # 1965 *Pimephales promelas* Acute		
Organism Age at Initiation	<24 hrs, all within an 8 hr window	<48 hrs, all within a 24 hour window	1 Days, within a 24 hour window		
Test Container Size	30 ml	800 ml	400 ml		
Test Volume	15 ml	500 ml	250 ml		
Feeding: Type and Amount	0.10 ml Algae and 0.10 ml YCT daily	0.15 ml *Artemia*, 2 x Daily	0.15 ml *Artemia*, @ 48 hrs		
Aeration: In Test Chambers via Slow Bubble :	☒ None ☐ Prior to use	☒ None ☐ Prior to use ☐ @ _____ hrs	☒ None ☐ Prior to use ☐ @ _____ hrs		
Acclimation Period	<24 hrs	<24 hrs	<24 hrs		
Organism Source	In-House	Aquatox	Aquatox		
Size	-	-	-		
Loading Rate	-	-	-		

Dissolved Oxygen aeration justifications (in test chambers):

Test(s): ☐ All ☐ _____

Date:

Comments:

TestAmerica

FRESHWATER TOXICITY TEST: TEST ORGANISM INFORMATION

Client: Energy Northwest

Sample Designation (SDG): B 3954

Test Species Information	Cd # ~~3312~~ 3402 Role 48 3-6-18 *Ceriodaphnia dubia* Chronic				
Organism Age at Initiation	<24 hrs, all within an 8 hr window				
Test Container Size	30 ml				
Test Volume	15 ml				
Feeding: Type and Amount	0.10 ml Algae and 0.10 ml YCT daily				
Aeration: In Test Chambers via Slow Bubble :	☒ None ☐ Prior to use				
Acclimation Period	<24 hrs				
Organism Source	In-House				
Size	-				
Loading Rate	-				

Dissolved Oxygen aeration justifications (in test chambers):

Test(s): ☐ All ☐ _____

Date:

Comments:

Test Solution Preparation and Dilution Record

Client: Energy Northwest

Note: ☐ Indicates task not done, ☑ Indicates task was done. Temp adj. = Temperature adjusted to ambient or test temp

Ditto marks ('') indicate that the same SDG, batch of dilution water, or food as the previous day's entry was used.

Ceriodaphnia dubia - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	200
1.0	2.00	→	200
3.3	6.60	→	200
11.0	22.0	→	200
33.0	66.0	→	200
100	200	→	200

Total Sample volume needed per day = 297 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	YCT ID Used	Algae ID Used	Date	Time	Initials
0 (Initiation)	B3934-01	☐ Temp adj, ☐ Aerated	ID # 4608	# 1150	# 1152	1/30/2018	10:45	DW
1	B -01	☐ Temp adj, ☐ Aerated	ID # 4608	#1150	#1152	1/31/18	08:25	"
2	B -02	☐ Temp adj, ☐ Aerated	ID # 4608	# 1148	# 1152	2/1/18	10:45	MB
3	B -07	☐ Temp adj, ☐ Aerated	ID # 4610	# 1148	# 1152	2/2/18	07:15	DW
4	B -03	☐ Temp adj, ☐ Aerated	ID # 4612	#1153	#1152	2/3/18	10:00	"
5	B -03	☐ Temp adj, ☐ Aerated	ID # 4612	#1153	#1152	2/4/"	0935	"
6	B -03	☐ Temp adj, ☐ Aerated	ID # 4612	# 1150	# 1152	2/5/18	06:40	MB
7	B -	☐ Temp adj, ☐ Aerated	ID #	#	#	/ /	:	

Fathead minnow - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	2000
1.0	20.0	→	2000
3.3	66.0	→	2000
11.0	220	→	2000
33.0	660	→	2000
100	2,000	→	2000

Total Sample volume needed per day = 2966 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
0 (Initiation)	B3934-01	☐ Temp adj, ☐ Aerated	ID # 4608	1/30/2018	10:45	DW
1	B -01	☐ Temp adj, ☐ Aerated	ID # 4608	1/31/18	08:25	"
2	B -02	☐ Temp adj, ☐ Aerated	ID # 4608	2/1/18	10:45	MB
3	B -07	☐ Temp adj, ☐ Aerated	ID # 4610	2/2/18	07:15	DW
4	B -03	☐ Temp adj, ☐ Aerated	ID # 4612	2/3/18	10:00	"
5	B -03	☐ Temp adj, ☐ Aerated	ID # 4612	2/4/"	0935	"
6	B -03	☐ Temp adj, ☐ Aerated	ID # 4612	2/5/18	06:40	MB

Fathead minnow - Acute

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	1000
6.25	62.5	→	1000
11.0	110	→	1000
25.0	250	→	1000
50.0	500	→	1000
100	1,000	→	1000

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
0 (Initiation)	B3934-01	☐ Temp adj, ☐ Aerated	ID # 4608	1/30/2018	10:45	DW
2	B -01	☐ Temp adj, ☐ Aerated	ID # 4609	2/1/2018	08:20	"

Total Sample volume needed per day = 1923 mls

Test Solution Preparation and Dilution Record

Client: Energy Northwest

Note: ☐ Indicates task not done, ☑ Indicates task was done. Temp adj. = Temperature adjusted to ambient or test temp

Ditto marks (' ') indicate that the same SDG, batch of dilution water, or food as the previous day's entry was used.

Ceriodaphnia dubia - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	200
1.0	2.00	→	200
3.3	6.60	→	200
11.0	22.0	→	200
33.0	66.0	→	200
100	200	→	200

Total Sample volume needed per day = 297 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	YCT ID Used	Algae ID Used	Date	Time	Initials
0 (Initiation)	B 3954-01	☐ Temp adj, ☐ Aerated	ID # 4620	# 1157	# 1155	2/27/2018	11:55	MB
1	B -01	☐ Temp adj, ☐ Aerated	ID # 4622	# 1157	# 1155	2/28/18	07:25	DW
2	B -02	☐ Temp adj, ☐ Aerated	ID # 4624	# 1157	# 1155	3/1/"18	11:55	BAM
3	B -02	☐ Temp adj, ☐ Aerated	ID # 4624	# 1153	# 1155	3/2/18	07:00	DW
4	B -03	☐ Temp adj, ☐ Aerated	ID # 4624	# 1153	# 1155	3/3/"18	09:45	"
5	B -03	☐ Temp adj, ☐ Aerated	ID # 4624	# 1157	# 1155	3/4/18	08:25	DW
6	B -03	☐ Temp adj, ☐ Aerated	ID # 4624	# 1157	# 1155	3/5/"18	08:40	MB
7	B -	☐ Temp adj, ☐ Aerated	ID #	#	#	/ /"	:	

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: Energy Northwest

Test Start Date: 1-30-2018

Sample Description:

Initial Sample ID#: B 3934

Data summarized by: DW

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	14	24	23	28	29	0	5	27	25	15	9	190
	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD?	AD?	AD?	AD?		
1.0 %	10	15	29	26	24	24	2	0	0	2	8	132
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD? ✓	AD?		
3.3 %	10	14	29	25	15	0	0	25	8	0	7	126
	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD? ✓	AD?	AD?	AD? ✓		
11.0 %	13	15	29	23	18	6	0	25	0	3	8	132
	AD?	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD?	AD? ✓	AD?		
33.0 %	17	12	8	25	33	3	0	9	0	2	8	109
	AD?	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD?	AD? ✓	AD?		
100 %	3	3	5	11	2	0	0	4	0	1	7	29
	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD? ✓	AD?	AD? ✓	AD?		

Survival data summarized through Day 7. 60%+ of surviving controls with 3+ broods first observed on Day 6.

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination (for WDOE only, = Number of test organisms alive at Day 7)

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CERIODAPHNIA CHRONIC SURVIVAL AND REPRODUCTION DATA

Neo's obtained from	A	B	C	D	E	F	G	H	I	J
Culture Board ID:	MH	BSK	BSK	BSK	BSK	D	D	D	D	D
Slot #:	21	B	G	H	I	7	32	49	56	59

Incubator Used: # 6
Random Template Used: 6 conc # 11

Client: Energy Northwest
Sample Description:
Initial Sample ID # B3934-01

Test Initiation: Date: 1 30 2018 Time: 11:15
Termination: Date: 2 6 2018 Time: 08:30

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Technician	DW	DW			Bm	Bm	MB	DW	
Time	1115	1140	1200	1015	1145	1115	1240	0830	

cd 3394

Percent	Day	Daily Number of Live Young for each Replicate A	B	C	D	E	F	G	H	I	J	No. Live Adults	Daily Total Live Young	
Control	1	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	0	0	0	AD	0	0	0	0	10	0	
	4	4	4	4	4	6		3	4	3	4	9	35	
	5	0	10	6	10	11		0	10	5	11	9	66	
	6	10	10	13	14	12		3	13	14	0	9	89	
	7	(15)	0	0	0	0		(12)	0	0	(17)	9	0	44
	8													
1.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	0	0	0	0	0	0	0	0	10	0	
	4	2	4	6	5	5	6	0	0 AD	0 AD	0	8	28	
	5	0	11	11	10	10	8	2	|	|	0	8	52	
	6	8	0	12	11	9	10	0	|	|	2	8	52	
	7	0	(14)	0	0	0	0	0	|	|	0	8	0	14
	8													
3.3 %	1	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	0	5	0	0 AD	0 AD	0	0	0	8	0	
	4	4	5	4	5	3	|	|	4	4	0	8	29	
	5	6	9	10	8	12	|	|	10	4	0	8	59	
	6	0	0	15	12	0	|	|	11	0	0 AD	7	38	
	7	(14)	(15)	0	0	(15)	|	|	0	(15)	|	7	0	59
	8					|				|				
11.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	0	0	0	0	0 AD	0	0 AD	0	8	0	
	4	5	6	4	8	6	3	|	3	|	0	8	35	
	5	8	9	11	0	12	0	|	12	|	0	8	52	
	6	0	0	14	15	0	3	|	10	|	3	8	45	
	7	(16)	(15)	0	0	(14)	(11)	|	0	|	(8)	8	0	64
	8					|				|				
33.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	0	0	0	0	0 AD	0	0 AD	0	8	0	
	4	4	5	4	4	6	2	0 AD	2	0 AD	0	8	27	
	5	6	7	4	9	10	0	|	7	|	0	8	43	
	6	7	0	8	12	17	1	|	8	|	2	8	39	
	7	0	(15)	(12)	0	0	0	|	(9)	|	0	8	0	36
	8							|		|				
100 %	1	0	0	0	0	0	0	0	0	0	0	10	0	
	2	0	0	0	0	0	0	0	0	0	0	10	0	
	3	0	0	0	0	0	0	0 AD	0	0	0	9	0	
	4	3	3	2	2	3	0 AD	|	3	0 AD	0	7	15	
	5	0	0	3	3	0	|	|	1	|	0	7	7	
	6	0	0	0 AY	6	0 AY	|	|	|	|	1	7	7	
	7	(6)	(2)	(3)	0	(4)	|	|	0 AY	|	0	7	0	15
	8					|				|				

"AD" = Adult Dead, "AY" = Aborted young, "M" = male organism, "F" = Female, "R" = Adult releasing young, " / " = split brood (carry-over brood / current day brood),
"Inj" = Adult Injured during test solution renewal, replicate removed from analysis. "AM" = Adult missing, remove from analysis. A circled neonate count = 4th brood

Footnote: As per WDOE, C. dubia test reproduction should be when 60% of the surviving control organisms have produced their third brood (Days 6, 7, or 8). Survival is at seven days.

TestAmerica

CERIODAPHNIA WATER QUALITY DATA

Client: Energy Northwest
Sample Description:
Initiated Date: 1/30/2018 Time: 11:15
Initial Sample ID #: B3934 -
Adults Isolated Date: 1/29/2018 Time: 23:00
Neo's Collected Date: 1/30/2018 Time: 06:30

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Tech:	DW	DW	e	e	Bm	Bm	MB	DW	
Time	11:15	11:40	12:55	11:10	11:55	11:45	13:00	08:30	:
Therm. #	251	251	251	251	251	251	251	251	#

Dissolved Oxygen (mg/l)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.7	8.0 / 8.0	7.7 / 8.0	7.8 / 7.9	7.9 / 8.0	8.2 / 8.2	7.8 / 7.9	7.8	
1.0 %	7.7	8.0 / 8.0	7.8 / 8.0	7.8 / 8.0	7.9 / 8.0	8.1 / 8.1	7.9 / 7.9	7.8	
3.3 %	7.6	8.0 / 8.0	8.0 / 8.0	8.1 / 7.8	7.8 / 7.6	7.9 / 7.6	7.9 / 8.0	7.9	
11.0 %	7.6	8.0 / 7.9	7.8 / 7.7	7.9 / 7.8	7.8 / 7.7	8.1 / 7.6	8.1 / 8.1	7.9	
33.0 %	7.6	8.1 / 7.8	7.9 / 7.9	7.7 / 7.8	7.8 / 7.6	8.2 / 7.9	8.2 / 8.2	7.9	
100 %	7.5	8.2 / 7.8	7.9 / 7.7	7.9 / 7.9	8.2 / 7.6	8.3 / 8.2	8.1 / 8.3	8.0	

pH

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.8	8.0 / 7.9	8.1 / 8.0	7.9 / 8.0	8.2 / 8.1	7.6 / 7.8	8.0 / 7.7	8.0	
1.0 %	7.9	8.0 / 8.0	8.1 / 8.0	7.9 / 8.0	8.1 / 8.1	7.6 / 7.9	8.0 / 8.1	8.1	
3.3 %	8.0	8.1 / 8.0	8.1 / 8.0	8.0 / 8.0	8.1 / 8.1	7.9 / 7.9	8.0 / 8.1	8.1	
11.0 %	8.0	8.1 / 8.0	8.1 / 8.0	8.0 / 8.0	8.1 / 8.1	7.9 / 7.9	8.0 / 8.1	8.2	
33.0 %	8.0	8.1 / 8.1	8.1 / 8.0	8.1 / 8.0	9.2 / 8.2	9.0 / 9.0	8.1 / 8.1	8.2	
100 %	8.0	8.3 / 8.1	8.2 / 8.1	8.2 / 8.1	9.3 / 9.2	9.1 / 9.1	8.2 / 8.1	8.3	

Temperature (°C) / Conductivity (µS) (1st use of each sample only)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	24.8 / 311	25.4	25.6 / 325	25.3	25.2 / 325	24.5	25.9	25.5	
1.0 %	24.7 / 327	25.7	25.1 / 338	24.9	25.2 / 339	24.6	25.5	25.7	
3.3 %	24.8 / 356	24.9	24.9 / 362	25.0	25.5 / 368	24.6	25.0	24.7	
11.0 %	24.8 / 449	25.3	24.5 / 448	25.4	24.2 / 463	24.7	25.4	25.9	
33.0 %	25.1 / 677	24.8	24.3 / 687	25.6	25.0 / 713	24.8	25.0	25.5	
100 %	24.9 / 1301	25.6	25.6 / 1364	25.3	25.9 / 1362	25.3	25.6	25.7	

COMMENTS: Temperatures taken just prior to test solution renewals. DO, pH, and Conductivity taken following organism transfer.

23.8 = Temp out of recom. range

Note: All Day 0 data represents conditions at initiation. All other days: numerator represents pre-renewal conditions, denominator represents post-renewal conditions.

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Batch ID:	08-5023-3729	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 11:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 08:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 21h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (0.6 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
08-3151-1845	7d Survival Rate	100	>100	N/A	N/A	1	Fisher Exact/Bonferroni-Holm Test
05-0351-0275	Reproduction	33	100	57.45	54.4%	3.03	Dunnett Multiple Comparison Test

Point Estimate Summary

< 1.0 BW 2/9/18

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
01-4992-2404	Reproduction	IC25	0.7641	0.402	44.13	130.9	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
08-3151-1845	7d Survival Rate	Control Resp	0.9	0.8 - NL	Yes	Passes Acceptability Criteria
01-4992-2404	Reproduction	Control Resp	19	15 - NL	Yes	Passes Acceptability Criteria
05-0351-0275	Reproduction	Control Resp	19	15 - NL	Yes	Passes Acceptability Criteria
05-0351-0275	Reproduction	PMSD	0.5438	0.13 - 0.47	Yes	Above Acceptability Criteria

7d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	0.9	0.7819	1	0	1	0.1	0.3162	35.14%	0.0%
1		10	0.8	0.6426	0.9574	0	1	0.1333	0.4216	52.7%	11.11%
3.3		10	0.7	0.5196	0.8804	0	1	0.1528	0.483	69.01%	22.22%
11		10	0.8	0.6426	0.9574	0	1	0.1333	0.4216	52.7%	11.11%
33		10	0.8	0.6426	0.9574	0	1	0.1333	0.4216	52.7%	11.11%
100		10	0.7	0.5196	0.8804	0	1	0.1528	0.483	69.01%	22.22%

Reproduction Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	19	15.22	22.78	0	29	3.197	10.11	53.21%	0.0%
1		10	13.2	8.783	17.62	0	29	3.741	11.83	89.62%	30.53%
3.3		10	12.6	8.494	16.71	0	29	3.478	11	87.28%	33.68%
11		10	13.2	9.233	17.17	0	29	3.359	10.62	80.48%	30.53%
33		10	10.9	6.74	15.06	0	33	3.523	11.14	102.2%	42.63%
100		10	2.9	1.65	4.15	0	11	1.059	3.348	115.5%	84.74%

Ceriodaphnia 7-d Survival and Reproduction Test
TestAmerica - ASL

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	0	1	1	1	1
1		1	1	1	1	1	1	1	0	0	1
3.3		1	1	1	1	1	0	0	1	1	0
11		1	1	1	1	1	1	0	1	0	1
33		1	1	1	1	1	1	0	1	0	1
100		1	1	1	1	1	0	0	1	0	1

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	14	24	23	28	29	0	5	27	25	15
1		10	15	29	26	24	24	2	0	0	2
3.3		10	14	29	25	15	0	0	25	8	0
11		13	15	29	23	18	6	0	25	0	3
33		17	12	8	25	33	3	0	9	0	2
100		3	3	5	11	2	0	0	4	0	1

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	08-3151-1845	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:46	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	08-5023-3729	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 11:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 08:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 21h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (0.6 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU
Untransformed		C > T	Not Run	100	>100	N/A	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Conc-%	Test Stat	P-Value	Decision(0.05)
Dilution Water		1	0.5	1.0000	Non-Significant Effect
		3.3	0.291	1.0000	Non-Significant Effect
		11	0.5	1.0000	Non-Significant Effect
		33	0.5	1.0000	Non-Significant Effect
		100	0.291	1.0000	Non-Significant Effect

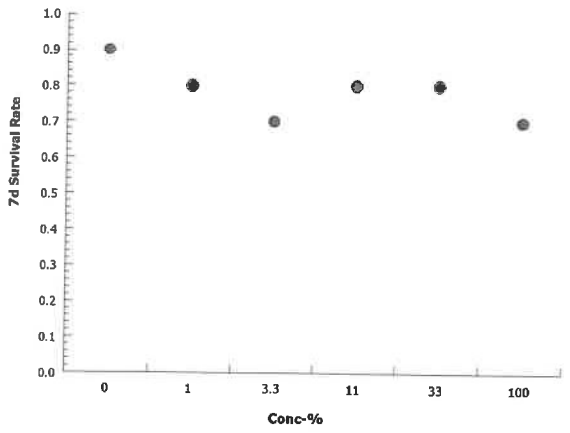
Data Summary

Conc-%	Control Type	No-Resp	Resp	Total
0	Dilution Water	9	1	10
1		8	2	10
3.3		7	3	10
11		8	2	10
33		8	2	10
100		7	3	10

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	0	1	1	1	1
1		1	1	1	1	1	1	1	0	0	1
3.3		1	1	1	1	1	0	0	1	1	0
11		1	1	1	1	1	1	0	1	0	1
33		1	1	1	1	1	1	0	1	0	1
100		1	1	1	1	1	0	0	1	0	1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	05-0351-0275	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:46	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-5023-3729	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 11:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 08:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 21h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (0.6 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run	33	100	57.45	3.03	54.4%

Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Dilution Water		1	1.285	2.289	18	10.33	0.2953	Non-Significant Effect
		3.3	1.418	2.289	18	10.33	0.2454	Non-Significant Effect
		11	1.285	2.289	18	10.33	0.2953	Non-Significant Effect
		33	1.794	2.289	18	10.33	0.1335	Non-Significant Effect
		100*	3.567	2.289	18	10.33	0.0018	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	0	2.289	3.2	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1362.533	272.5067	5	2.675	0.0313	Significant Effect
Error	5501.4	101.8778	54			
Total	6863.933	374.3844	59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	12.21	15.09	0.0321	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9707	0.9459	0.1574	Normal Distribution

Reproduction Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	19	15.15	22.85	0	29	3.197	10.11	53.21%	0.0%
1		10	13.2	8.7	17.7	0	29	3.741	11.83	89.62%	30.53%
3.3		10	12.6	8.417	16.78	0	29	3.478	11	87.28%	33.68%
11		10	13.2	9.159	17.24	0	29	3.359	10.62	80.48%	30.53%
33		10	10.9	6.663	15.14	0	33	3.523	11.14	102.2%	42.63%
100		10	2.9	1.626	4.174	0	11	1.059	3.348	115.5%	84.74%

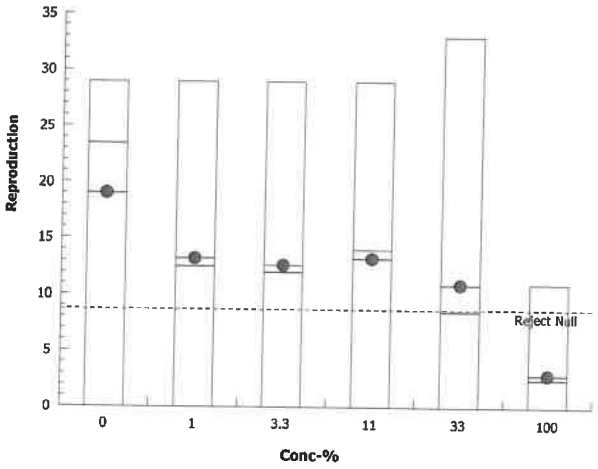
Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

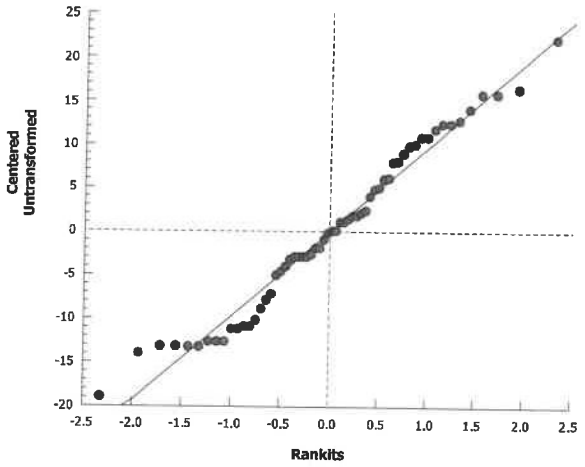
Analysis ID:	05-0351-0275	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:46	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	14	24	23	28	29	0	5	27	25	15
1		10	15	29	26	24	24	2	0	0	2
3.3		10	14	29	25	15	0	0	25	8	0
11		13	15	29	23	18	6	0	25	0	3
33		17	12	8	25	33	3	0	9	0	2
100		3	3	5	11	2	0	0	4	0	1

Graphics





CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	01-4992-2404	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:47	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	08-5023-3729	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 11:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 08:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 21h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (0.6 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1.498E+09	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value	2.289	3.2	1.0000	No Outliers Detected

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	0.7641	0.402	44.13	130.9	2.266	248.8

Reproduction Summary

			Calculated Variate						
Conc-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	19	0	29	3.197	10.11	53.21%	0.0%
1		10	13.2	0	29	3.741	11.83	89.62%	30.53%
3.3		10	12.6	0	29	3.478	11	87.28%	33.68%
11		10	13.2	0	29	3.359	10.62	80.48%	30.53%
33		10	10.9	0	33	3.523	11.14	102.2%	42.63%
100		10	2.9	0	11	1.059	3.348	115.5%	84.74%

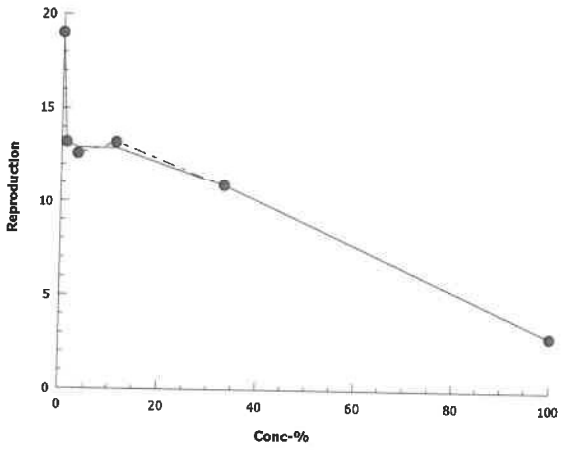
Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	14	24	23	28	29	0	5	27	25	15
1		10	15	29	26	24	24	2	0	0	2
3.3		10	14	29	25	15	0	0	25	8	0
11		13	15	29	23	18	6	0	25	0	3
33		17	12	8	25	33	3	0	9	0	2
100		3	3	5	11	2	0	0	4	0	1

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	01-4992-2404	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:47	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: Energy Northwest Test Start Date: 2-27-18

Sample Description: Initial Sample ID#: B 3954

Data summarized by: MJS

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	33	36	33	29	33	33	3	35	35	35	9	305
	AD?	AD?	AD?	AD?	AD?	AD?	AD? X	AD?	AD?	AD?		
1.0 %	32	33	28	35	27	33	29	33	29	32	10	311
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
3.3 %	32	30	32	29	32	30	34	36	29	30	10	314
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
11.0 %	34	39	32	29	31	37	36	34	29	32	10	333
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
33.0 %	13	30	26	15	14	33	25	29	30	29	10	248
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
100 %	5	10	0	0	0	8	1	7	3	6	6	40
	AD?	AD?	AD? X	AD? X	AD? X	AD?	AD? X	AD?	AD?	AD?		

Survival data summarized through Day 7. 60%+ of surviving controls with 3+ broods first observed on Day 9.

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination (for WDOE only, = Number of test organisms alive at Day 7)

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CERIODAPHNIA CHRONIC SURVIVAL AND REPRODUCTION DATA

Neo's obtained from	A	B	C	D	E	F	G	H	I	J
Culture Board ID:	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Slot #:	3	5	11	15	16	18	25	27	33	38

Incubator Used: # 6
Random Template Used: 6 conc # 10

Client: Energy Northwest
Sample Description:
Initial Sample ID # B3954-01

Test Initiation: Date: 2/27/2018 Time: 12:45
Termination: Date: 3/6/2018 Time: 08:20

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Technician		DW		MB	DW	DW	MB	DW	
Time	1245	0840	1310	1010	1050	1015	1325	0820	

CA 3402

Percent	Day	Daily Number of Live Young for each Replicate A	B	C	D	E	F	G	H	I	J	No. Live Adults	Daily Total Live Young
Control	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	5	4	5	0	3 AD	5	4	0	10	26
	4	6	6	0	1/0	0	6	|	0	2/0	6	9	27
	5	11	12	10	9	12	10	|	14	11	12	9	101
	6	16	18	18	15	16	17	|	16	18	17	9	151
	7							—				9	—
	8												
1.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	0	0	0	0	0	0	0	0	10	0
	4	5	6	5	0	0	6	5	0	4	0	10	19
	5	12	14	9	12	9	11	10	13	9	12	10	32
	6	15	13	14	17	14	14	14	15	16	15	10	111
	7											10	149
	8												—
3.3 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	4	5	4	4	5	5	6	0	6	0	10	39
	4	0	0	0	9	10	0	0	6	8	5	10	30
	5	13	9	12	2/0	0	13	12	13	9	11	10	94
	6	15	16	16	14	17	12	16	17	14	14	10	151
	7											10	—
	8												
11.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	6	3	3	6	6	0	5	0	10	29
	4	5	6	0	2/0	1/0	0	0	6	0	5	10	25
	5	12	15	11	9	11	12	14	11	10	11	10	118
	6	17	18	15	15	16	19	16	17	14	16	10	163
	7											10	—
	8												
33.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	3	4	0	3	3	0	4	5	0	0	10	17
	4	1/0	0	4	1/0	1/0	5	0	0	6	5	10	23
	5	9	12	12	0	9	13	9	11	12	10	10	88
	6	0	14	10	11	14	15	12	13	12	14	10	115
	7											10	—
	8												
100 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	2	0	0	0 AD	0 AD	0	0	0	0	0	8	2
	4	0	0	0	|	|	3	0	0	1	0	8	4
	5	3	4	0/AD	|	|	5	1	2	0	7	18
	6	0 AY	6	|	|	|	0 AY	0	5	2 AY	3	7	16
	7			|	|	|		0/AD				6	—
	8			↓	↓	↓							

"AD" = Adult Dead, "AY" = Aborted young, "M" = male organism, "F" = Female, "R" = Adult releasing young, " / " = split brood (carry-over brood / current day brood), "Inj" = Adult Injured during test solution renewal, replicate removed from analysis. "AM" = Adult missing, remove from analysis. A circled neonate count = 4th brood

Footnote: As per WDOE, C. dubia test reproduction should be when 60% of the surviving control organisms have produced their third brood (Days 6, 7, or 8). Survival is at seven days.

TestAmerica

CERIODAPHNIA WATER QUALITY DATA

Client: Energy Northwest
Sample Description:
Initiated Date 2/27/2018 Time 12 : 45
Initial Sample ID # B 3954 -01→03
Adults Isolated Date 2/26/2018 Time 23 : 00
Neo's Collected Date 2/27/2018 Time 07 : 00

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Tech:		DW		MB	DW	DW	MB	DW	
Time	12 : 45	08 : 40	13 : 50	10 : 40	10 : 50	10 : 15	14 : 00	08 : 20	:
Therm.	# 251	# 251	# 251	# 251	# 251	# 251	# 251	# 251	#

Dissolved Oxygen (mg/l)

%	Day 0	1	2	3	4	5	6	7	8
Control	7.7	7.6 / 7.5	7.4 / 7.5	7.8 / 7.5	8.0 / 7.4	7.6 / 7.7	7.7 / 8.1	7.8	
1.0 %	7.7	7.7 / 7.5	7.6 / 7.8	7.8 / 7.9	8.0 / 7.5	7.6 / 7.7	7.7 / 8.0	7.8	
3.3 %	7.6	7.7 / 7.6	7.6 / 7.7	7.8 / 7.9	8.0 / 7.7	7.7 / 7.7	7.8 / 8.0	7.8	
11.0 %	7.6	7.7 / 7.7	7.6 / 7.6	7.8 / 7.9	8.1 / 7.9	7.8 / 7.8	7.9 / 8.2	7.7	
33.0 %	7.7	7.8 / 7.7	7.6 / 7.6	7.9 / 7.9	8.1 / 8.0	7.8 / 7.8	8.0 / 8.2	7.9	
100 %	7.7	7.9 / 7.8	7.6 / 7.6	7.9 / 7.9	8.2 / 8.1	7.9 / 7.8	8.0 / 7.9	8.1	

pH

%	Day 0	1	2	3	4	5	6	7	8
Control	6.5	7.5 / 7.8	7.9 / 8.0	8.2 / 8.0	7.9 / 8.2	7.8 / 8.1	7.8 / 7.9	7.6	
1.0 %	6.7	7.5 / 7.8	7.9 / 8.0	8.2 / 8.1	7.9 / 8.3	7.8 / 8.2	7.8 / 7.9	7.7	
3.3 %	6.8	7.6 / 7.8	7.9 / 7.9	8.2 / 8.1	7.9 / 8.2	7.9 / 8.2	7.8 / 7.9	7.8	
11.0 %	6.9	7.6 / 7.8	7.9 / 7.9	8.2 / 8.1	8.0 / 8.2	7.9 / 8.1	7.9 / 7.8	7.9	
33.0 %	7.0	7.6 / 7.6	7.9 / 7.5	8.2 / 8.1	8.2 / 8.2	8.0 / 8.1	7.9 / 7.8	8.1	
100 %	7.0	7.7 / 7.3	8.0 / 8.0	8.3 / 8.1	8.2 / 8.1	8.1 / 8.0	8.0 / 7.9	8.1	

Temperature (°C) / Conductivity (µS) (1st use of each sample only)

%	Day 0	1	2	3	4	5	6	7	8
Control	25.0 / 216	24.1	25.0 / 322	24.9	24.6 / 316	25.3	24.1	24.8	
1.0 %	24.9 / 340	25.2	24.6 / 333	25.2	25.3	24.7	24.6	25.3	
3.3 %	24.9 / 367	24.6	25.1 / 356	26.0	24.5	24.4	26.0	25.7	
11.0 %	24.9 / 425	25.7	25.0 / 446	25.3	25.1	24.9	25.7	24.7	
33.0 %	24.9 / 677	25.2	24.9 / 688	24.7	24.6	25.8	25.6	25.9	
100 %	24.7 / 1265	24.6	25.0 / 1268	24.3	24.8 / 1280	25.2	25.7	24.9	

COMMENTS: Temperatures taken just prior to test solution renewals. DO, pH, and Conductivity taken following organism transfer.

23.8 = Temp out of recom. range

Note: All Day 0 data represents conditions at initiation. All other days: numerator represents pre-renewal conditions, denominator represents post-renewal conditions.

CETIS Summary Report

Test Code: B395401cdc | 07-6175-3278

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Batch ID:	21-4708-4877	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	27 Feb-18 12:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Mar-18 08:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-0055-0816	**Code:**	B3954-01	**Client:**	
Sample Date:	26 Feb-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	27 Feb-18 11:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	31h (3.1 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
11-3431-2249	2d Survival Rate	100	>100	N/A	N/A	1	Fisher Exact/Bonferroni-Holm Test
16-7093-8134	6d Survival Rate	100	>100	N/A	N/A	1	Fisher Exact/Bonferroni-Holm Test
04-2022-1814	Reproduction	11	33	19.05	12.8%	9.091	Wilcoxon/Bonferroni Adj Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
17-4883-0280	2d Survival Rate	EC50	>100	N/A	N/A	<1	Linear Interpolation (ICPIN)
17-4848-1303	Reproduction	IC25	35.05	21.34	41.69	2.853	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
04-2022-1814	Reproduction	Control Resp	33.56	15 - NL	Yes	Passes Acceptability Criteria
17-4848-1303	Reproduction	Control Resp	30.5	15 - NL	Yes	Passes Acceptability Criteria
04-2022-1814	Reproduction	PMSD	0.1282	0.13 - 0.47	Yes	Below Acceptability Criteria

2d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	1	1	1	1	1	0	0	0.0%	0.0%
1		10	1	1	1	1	1	0	0	0.0%	0.0%
3.3		10	1	1	1	1	1	0	0	0.0%	0.0%
11		10	1	1	1	1	1	0	0	0.0%	0.0%
33		10	1	1	1	1	1	0	0	0.0%	0.0%
100		10	1	1	1	1	1	0	0	0.0%	0.0%

6d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	0.9	0.7819	1	0	1	0.1	0.3162	35.14%	0.0%
1		10	1	1	1	1	1	0	0	0.0%	-11.11%
3.3		10	1	1	1	1	1	0	0	0.0%	-11.11%
11		10	1	1	1	1	1	0	0	0.0%	-11.11%
33		10	1	1	1	1	1	0	0	0.0%	-11.11%
100		10	0.6	0.4072	0.7928	0	1	0.1633	0.5164	86.07%	33.33%

Reproduction Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	30.5	26.82	34.18	3	36	3.117	9.857	32.32%	0.0%
1		10	31.1	30.11	32.09	27	35	0.836	2.644	8.5%	-1.97%
3.3		10	31.4	30.55	32.25	29	36	0.718	2.271	7.23%	-2.95%
11		10	33.3	32.05	34.55	29	39	1.055	3.335	10.02%	-9.18%
33		10	24.8	22.19	27.41	13	33	2.21	6.989	28.18%	18.69%
100		10	4	2.614	5.386	0	10	1.174	3.712	92.8%	86.89%

Analyst: DW QA:

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

2d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

6d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	0	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	0	0	0	1	0	1	1	1

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	33	36	33	29	33	33	3	35	35	35
1		32	33	28	35	27	33	29	33	29	32
3.3		32	30	32	29	32	30	34	36	29	30
11		34	39	32	29	31	37	36	34	29	32
33		13	30	26	15	18	33	25	29	30	29
100		5	10	0	0	0	8	1	7	3	6

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	17-4883-0280	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.8.1
Analyzed:	07 Mar-18 12:07	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	21-4708-4877	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	27 Feb-18 12:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Mar-18 08:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-0055-0816	**Code:**	B3954-01	**Client:**	
Sample Date:	26 Feb-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	27 Feb-18 11:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	31h (3.1 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1.136E+09	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC50	>100	N/A	N/A	<1	N/A	N/A

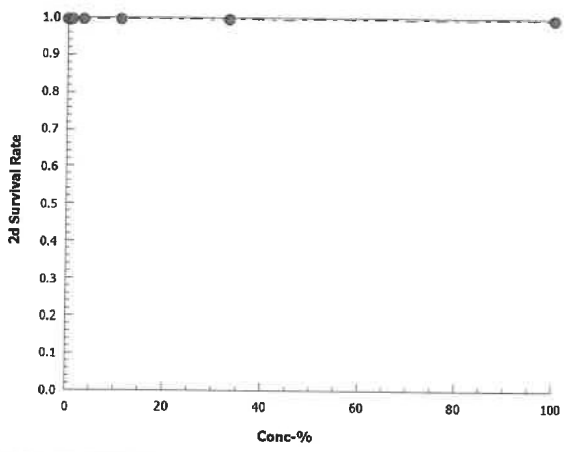
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Dilution Water	10	1	1	1	0	0	0.0%	0.0%	10	10
1		10	1	1	1	0	0	0.0%	0.0%	10	10
3.3		10	1	1	1	0	0	0.0%	0.0%	10	10
11		10	1	1	1	0	0	0.0%	0.0%	10	10
33		10	1	1	1	0	0	0.0%	0.0%	10	10
100		10	1	1	1	0	0	0.0%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	11-3431-2249	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.8.1
Analyzed:	07 Mar-18 12:07	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	21-4708-4877	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	27 Feb-18 12:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Mar-18 08:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-0055-0816	**Code:**	B3954-01	**Client:**	
Sample Date:	26 Feb-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	27 Feb-18 11:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	31h (3.1 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU
Untransformed		C > T	Not Run	100	>100	N/A	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Conc-%	Test Stat	P-Value	Decision(0.05)
Dilution Water		1	1	1.0000	Non-Significant Effect
		3.3	1	1.0000	Non-Significant Effect
		11	1	1.0000	Non-Significant Effect
		33	1	1.0000	Non-Significant Effect
		100	1	1.0000	Non-Significant Effect

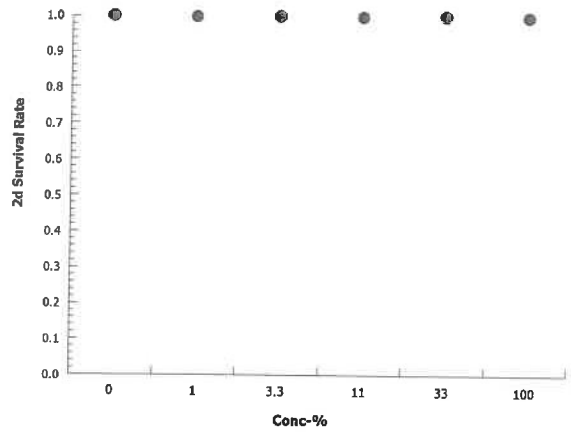
Data Summary

Conc-%	Control Type	No-Resp	Resp	Total
0	Dilution Water	10	0	10
1		10	0	10
3.3		10	0	10
11		10	0	10
33		10	0	10
100		10	0	10

2d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	16-7093-8134	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.8.1
Analyzed:	07 Mar-18 12:07	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	21-4708-4877	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	27 Feb-18 12:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Mar-18 08:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-0055-0816	**Code:**	B3954-01	**Client:**	
Sample Date:	26 Feb-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	27 Feb-18 11:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	31h (3.1 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU
Untransformed		C > T	Not Run	100	>100	N/A	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Conc-%	Test Stat	P-Value	Decision(0.05)
Dilution Water		1	1	1.0000	Non-Significant Effect
		3.3	1	1.0000	Non-Significant Effect
		11	1	1.0000	Non-Significant Effect
		33	1	1.0000	Non-Significant Effect
		100	0.1517	0.7585	Non-Significant Effect

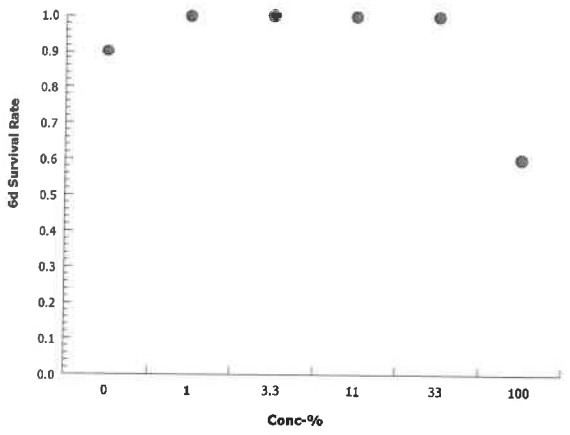
Data Summary

Conc-%	Control Type	No-Resp	Resp	Total
0	Dilution Water	9	1	10
1		10	0	10
3.3		10	0	10
11		10	0	10
33		10	0	10
100		6	4	10

6d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	0	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	0	0	0	1	0	1	1	1

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	04-2022-1814	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	07 Mar-18 12:08	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	21-4708-4877	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	27 Feb-18 12:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Mar-18 08:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-0055-0816	**Code:**	B3954-01	**Client:**	
Sample Date:	26 Feb-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	27 Feb-18 11:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	31h (3.1 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run	11	33	19.05	9.091	12.8%

Wilcoxon/Bonferroni Adj Test

Control	vs	Conc-%	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
Dilution Water		1	73.5		17	3	0.0698	Non-Significant Effect
		3.3	75.5		17	2	0.1087	Non-Significant Effect
		11	95.5		17	2	1.0000	Non-Significant Effect
		33*	61		17	2	0.0016	Significant Effect
		100*	55		17	0	<0.0001	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6449.456	1289.891	5	84.69	<0.0001	Significant Effect
Error	807.2222	15.23061	53			
Total	7256.678	1305.122	58			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	19.31	15.09	0.0017	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9716	0.9451	0.1816	Normal Distribution

Reproduction Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	9	33.56	32.77	34.34	29	36	0.6894	2.068	6.16%	0.0%
1		10	31.1	30.09	32.11	27	35	0.836	2.644	8.5%	7.32%
3.3		10	31.4	30.54	32.26	29	36	0.718	2.271	7.23%	6.42%
11		10	33.3	32.03	34.57	29	39	1.055	3.335	10.02%	0.76%
33		10	24.8	22.14	27.46	13	33	2.21	6.989	28.18%	26.09%
100		10	4	2.588	5.412	0	10	1.174	3.712	92.8%	88.08%

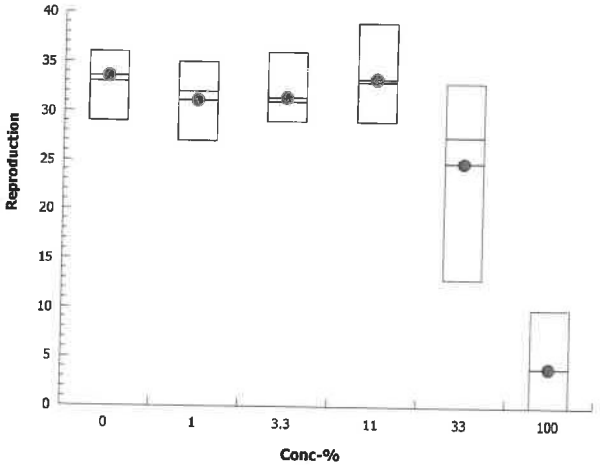
Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

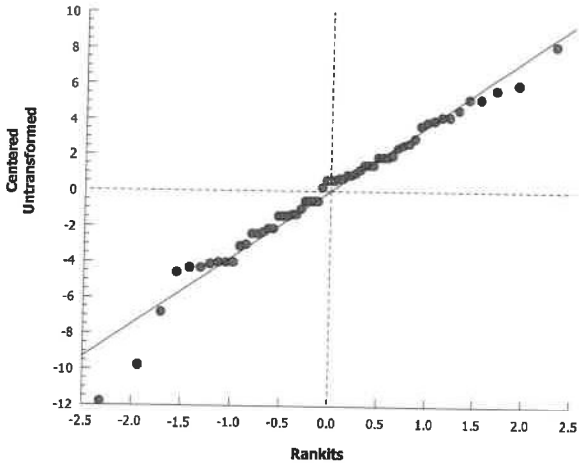
Analysis ID:	04-2022-1814	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	07 Mar-18 12:08	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	33	36	33	29	33	33	Outlier	35	35	35
1		32	33	28	35	27	33	29	33	29	32
3.3		32	30	32	29	32	30	34	36	29	30
11		34	39	32	29	31	37	36	34	29	32
33		13	30	26	15	18	33	25	29	30	29
100		5	10	0	0	0	8	1	7	3	6

Graphics





CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	17-4848-1303	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.1
Analyzed:	07 Mar-18 12:08	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	21-4708-4877	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	27 Feb-18 12:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Mar-18 08:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 20h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-0055-0816	**Code:**	B3954-01	**Client:**	
Sample Date:	26 Feb-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	27 Feb-18 11:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	31h (3.1 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	786473660	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	35.05	21.34	41.69	2.853	2.399	4.687

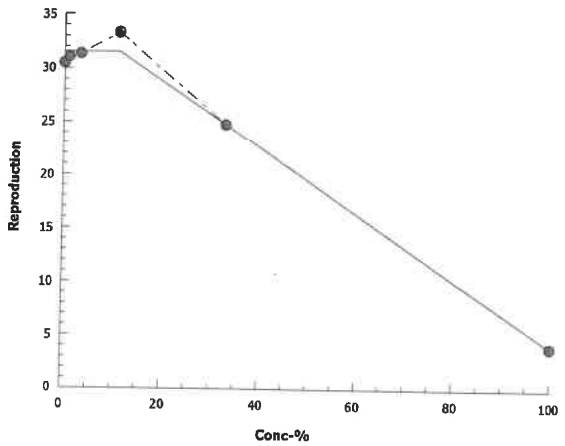
Reproduction Summary

			Calculated Variate						
Conc-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	30.5	3	36	3.117	9.857	32.32%	0.0%
1		10	31.1	27	35	0.836	2.644	8.5%	-1.97%
3.3		10	31.4	29	36	0.718	2.271	7.23%	-2.95%
11		10	33.3	29	39	1.055	3.335	10.02%	-9.18%
33		10	24.8	13	33	2.21	6.989	28.18%	18.69%
100		10	4	0	10	1.174	3.712	92.8%	86.89%

Reproduction Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	33	36	33	29	33	33	3	35	35	35
1		32	33	28	35	27	33	29	33	29	32
3.3		32	30	32	29	32	30	34	36	29	30
11		34	39	32	29	31	37	36	34	29	32
33		13	30	26	15	18	33	25	29	30	29
100		5	10	0	0	0	8	1	7	3	6

Graphics



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 2 | Waterbath/incubator Used: # 4 | Date Initiated 1/30/2018 Time 12:50

Initial sample ID B 3934 - 01 | Date Terminated 2/6/2018 Time 09:20

Client Energy Northwest | Sample Description

Tech: Day 0 MB Day 1 BAM Day 2 BM Day 3 MB Day 4 BM Day 5 BM Day 6 BAM Day 7 BAM

Time: Day 0 1250 Day 1 1150 Day 2 1310 Day 3 0945 Day 4 1215 Day 5 1255 Day 6 1130 Day 7 0920

Conc. or Percent	Day	Number of Live Organisms				Dissolved O_2 (mg/l)		pH		Temp. (°C)	Therm. ID #	Conductivity (µS)
		A	B	C	D	Pre	Post	Pre	Post	Pre		Post (1st use)
Control	0	10	10	10	10		7.4		8.0	Post: 25.0	254	318
	1	10	10	10	10	6.8	7.4	7.4	8.2	24.9	254	
	2	10	10	10	10	6.7	7.8	7.6	8.2	24.4	254	314
	3	10	10	10	10	7.1	7.3	7.5	8.2	25.1	254	
	4	10	10	10	10	6.9	7.2	7.5	8.3	24.6	254	318
	5	10	10	10	10	6.5	7.9	7.4	8.3	24.8	254	
	6	10	10	10	10	6.7	8.0	7.5	8.2	24.8	255	
	7	10	10	10	10	6.6		7.6		24.8	255	
1.0 %	0	10	10	10	10		7.5		8.1	Post: 24.7		320
	1	10	10	10	10	6.8	7.9	7.4	8.1	24.7		
	2	10	10	10	10	6.8	7.8	7.6	8.2	24.6		333
	3	10	9	10	10	7.5	7.7	7.6	8.2	25.0		
	4	10	9	10	10	6.7	7.5	7.5	8.3	24.6		335
	5	10	9	10	10	6.5	7.9	7.4	8.3	24.9		
	6	10	8	10	10	6.9	8.0	7.5	8.2	25.1		
	7	10	7	10	10	6.8		7.6		25.0		
3.3 %	0	10	10	10	10		7.7		8.1	Post: 24.6		349
	1	10	10	10	10	6.3	8.0	7.4	8.1	24.8		
	2	10	10	10	10	6.5	7.9	7.5	8.2	24.8		361
	3	10	10	10	10	7.2	7.9	7.6	8.1	24.9		
	4	10	10	10	10	6.6	7.6	7.5	8.3	24.6		362
	5	10	10	9	10	6.5	8.0	7.4	8.2	24.9		
	6	10	10	9	10	6.9	8.2	7.5	8.2	25.0		
	7	10	10	9	10	6.9		7.6		24.9		
11.0 %	0	10	10	10	10		7.9		8.1	Post: 24.8		424
	1	10	10	10	10	6.3	8.1	7.4	8.1	24.6		
	2	10	10	10	10	6.4	7.9	7.6	8.2	24.4		458
	3	10	10	10	10	7.1	7.9	7.6	8.1	24.8		
	4	10	10	10	10	6.6	7.7	7.6	8.3	24.5		443
	5	10	10	10	10	6.3	7.9	7.4	8.2	24.8		
	6	10	10	10	10	7.0	8.2	7.5	8.2	25.1		
	7	10	10	10	10	6.8		7.6		25.0		
33.0 %	0	10	10	10	10		7.8		8.0	Post: 24.7		676
	1	10	10	10	10	6.4	8.2	7.4	8.1	24.8		
	2	10	10	9	10	6.2	8.2	7.6	8.2	24.4		667
	3	10	10	9	10	7.2	8.1	7.6	8.1	25.0		
	4	10	10	9	10	7.0	8.2	7.6	8.3	24.5		687
	5	10	10	9	9	6.2	7.9	7.5	8.2	24.8		
	6	10	10	9	9	7.1	8.10	7.6	8.1	24.8		
	7	10	10	9	9	6.8		7.6		24.8		
100 %	0	10	10	10	10		8.1		8.1	Post: 24.3		1339
	1	10	10	10	10	6.5	8.3	7.9	8.1	24.8		
	2	10	10	10	10	6.4	8.3	7.9	8.2	24.5		1330
	3	10	10	10	10	7.2	8.3	7.7	8.1	25.0		
	4	10	10	10	10	6.9	7.8 8.0	7.8	8.2	24.6		1351
	5	10	10	10	10	6.3	8.1	7.9	8.2	24.8		
	6	10	10	10	10	7.1	8.2	7.8	8.1	25.1		
	7	10	10	10	10	6.7		7.9		25.0		

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.

"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.

"F" = fungus noted on dead organisms.

☐ Aeration in test chambers begun @ _____ (Note observations on Test Organism Info sheet)

Pre =Pre-renewal solutions. Post =Post-renewal solutions.

Day 0 Temperatures = Post-renewals

Therm ID# = Thermometer ID used for all measurements that day.

(23.8) = Temp. out of recommended range

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy NW | Tins Labeled As: Energy

Lab ID: B3934 | Start Date: 1/30/2018

Sample Description:

Technician:	MB	MB
Date:	2/7/2018	2/2/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A	1104.25	1096.42	10
	B	1092.64	1085.75	10
	C	1119.28	1110.52	10
	D	1097.84	1089.98	10
1.0 %	A	1111.87	1104.89	10
	B	1110.15	1104.37	7
	C	1114.48	1106.74	10
	D	1120.24	1112.66	10
3.3 %	A	1095.45	1088.46	10
	B	1124.88	1116.57	10
	C	1113.30	1106.81	9
	D	1100.89	1093.18	10
11 %	A	1104.67	1097.08	10
	B	1110.36	1101.67	10
	C	1094.35	1087.02	10
	D	1121.24	1114.22	10
33 %	A	1123.69	1115.85	10
	B	1106.01	1098.00	10
	C	1105.92	1097.39	9
	D	1103.21	1095.77	9
100 %	A	1101.56	1093.96	10
	B	1088.87	1080.62	10
	C	1113.43	1103.91	10
	D	1115.13	1105.79	10
	A			
	B			
	C			
	D			

weigh to 0.01 mg

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy NW | Tins Labeled As: Energy

Lab ID: B3934 | Start Date: 1/30/2018

Sample Description:

Technician:		MB
Date:		2/2/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A		1096.42	10
	B		1085.75	10
	C		1110.52	10
	D		1089.98	10
1.0 %	A		1104.89	10
	B		1104.37	7
	C		1106.74	10
	D		1112.66	10
3.3 %	A		1088.46	10
	B		1116.57	10
	C		1106.81	9
	D		1093.18	10
11 %	A		1097.08	10
	B		1101.67	10
	C		1087.02	10
	D		1114.22	10
33 %	A		1115.85	10
	B		1098.00	10
	C		1097.39	9
	D		1095.77	9
100 %	A		1093.96	10
	B		1080.62	10
	C		1103.91	10
	D		1105.79	10
	A			
	B			
	C			
	D			

weigh to 0.01 mg

CETIS Summary Report

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Batch ID:	08-0704-4629	**Test Type:**	Growth-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 12:50	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 09:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 21h	**Source:**	Aquatox, AR	**Age:**	<48h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	32h (0.6 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
04-8701-0464	7d Survival Rate	100	>100	N/A	10.4%	1	Steel Many-One Rank Test
11-4303-9384	Mean Dry Biomass-mg	100	>100	N/A	16.8%	1	Dunnett Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
13-5518-0232	Mean Dry Biomass-mg	IC25	>100	N/A	N/A	<1	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
04-8701-0464	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
11-4303-9384	Mean Dry Biomass-mg	Control Resp	0.7835	0.25 - NL	Yes	Passes Acceptability Criteria
13-5518-0232	Mean Dry Biomass-mg	Control Resp	0.7835	0.25 - NL	Yes	Passes Acceptability Criteria
11-4303-9384	Mean Dry Biomass-mg	PMSD	0.1677	0.12 - 0.3	Yes	Passes Acceptability Criteria

7d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
1		4	0.925	0.869	0.981	0.7	1	0.075	0.15	16.22%	7.5%
3.3		4	0.975	0.9563	0.9937	0.9	1	0.025	0.05	5.13%	2.5%
11		4	1	1	1	1	1	0	0	0.0%	0.0%
33		4	0.95	0.9284	0.9716	0.9	1	0.02887	0.05774	6.08%	5.0%
100		4	1	1	1	1	1	0	0	0.0%	0.0%

Mean Dry Biomass-mg Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.7835	0.755	0.812	0.689	0.876	0.03818	0.07636	9.75%	0.0%
1		4	0.702	0.6688	0.7352	0.578	0.774	0.04445	0.0889	12.66%	10.4%
3.3		4	0.7375	0.7076	0.7674	0.649	0.831	0.03998	0.07996	10.84%	5.87%
11		4	0.7658	0.7386	0.7929	0.702	0.869	0.03633	0.07267	9.49%	2.27%
33		4	0.7955	0.7786	0.8124	0.744	0.853	0.02259	0.04517	5.68%	-1.53%
100		4	0.8678	0.8337	0.9018	0.76	0.952	0.04557	0.09115	10.5%	-10.75%

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
1		1	0.7	1	1
3.3		1	1	0.9	1
11		1	1	1	1
33		1	1	0.9	0.9
100		1	1	1	1

Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.783	0.689	0.876	0.786
1		0.698	0.578	0.774	0.758
3.3		0.699	0.831	0.649	0.771
11		0.759	0.869	0.733	0.702
33		0.784	0.801	0.853	0.744
100		0.76	0.825	0.952	0.934

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	04-8701-0464	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:52	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Batch ID:	08-0704-4629	**Test Type:**	Growth-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 12:50	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 09:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 21h	**Source:**	Aquatox, AR	**Age:**	<48h

Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	32h (0.6 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run	100	>100	N/A	1	10.4%

Steel Many-One Rank Test

Control	vs	Conc-%	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
Dilution Water		1	16	10	6	1	0.6105	Non-Significant Effect
		3.3	16	10	6	1	0.6105	Non-Significant Effect
		11	18	10	6	1	0.8333	Non-Significant Effect
		33	14	10	6	1	0.3451	Non-Significant Effect
		100	18	10	6	1	0.8333	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	0	3.575	2.802	0.0004	Outlier Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.04299308	0.008598616	5	0.8631	0.5245	Non-Significant Effect
Error	0.1793209	0.009962271	18			
Total	0.222314	0.01856089	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	1.013	4.248	0.4386	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7721	0.884	0.0001	Non-normal Distribution

7d Survival Rate Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
1		4	0.925	0.8679	0.9821	0.7	1	0.075	0.15	16.22%	7.5%
3.3		4	0.975	0.956	0.994	0.9	1	0.025	0.05	5.13%	2.5%
11		4	1	1	1	1	1	0	0	0.0%	0.0%
33		4	0.95	0.928	0.972	0.9	1	0.02887	0.05773	6.08%	5.0%
100		4	1	1	1	1	1	0	0	0.0%	0.0%

Angular (Corrected) Transformed Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1.412	1.412	1.412	1.412	1.412	0	0	0.0%	0.0%
1		4	1.307	1.227	1.387	0.9912	1.412	0.1052	0.2104	16.1%	7.45%
3.3		4	1.371	1.34	1.402	1.249	1.412	0.04074	0.08149	5.94%	2.89%
11		4	1.412	1.412	1.412	1.412	1.412	0	0	0.0%	0.0%
33		4	1.331	1.295	1.366	1.249	1.412	0.04705	0.09409	7.07%	5.77%
100		4	1.412	1.412	1.412	1.412	1.412	0	0	0.0%	0.0%

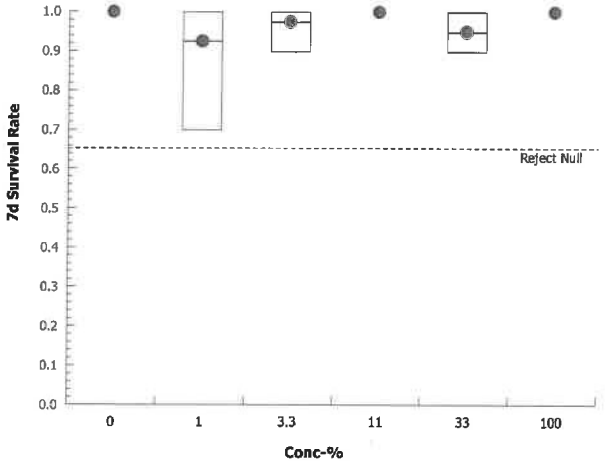
Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

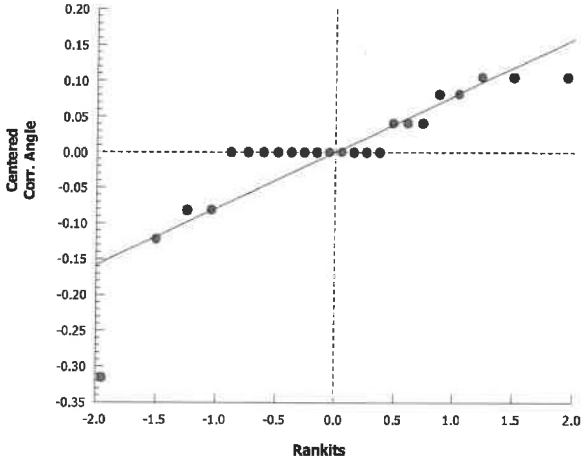
Analysis ID:	04-8701-0464	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:52	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

7d Survival Rate Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
1		1	0.7	1	1
3.3		1	1	0.9	1
11		1	1	1	1
33		1	1	0.9	0.9
100		1	1	1	1

Graphics





CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — TestAmerica - ASL

Analysis ID:	11-4303-9384	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:52	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	08-0704-4629	**Test Type:**	Growth-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 12:50	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 09:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 21h	**Source:**	Aquatox, AR	**Age:**	<48h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	32h (0.6 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	MC Trials	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run	100	>100	N/A	1	16.8%

Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
Dilution Water		1	1.493	2.407	6	0.1314	0.2302	Non-Significant Effect
		3.3	0.8427	2.407	6	0.1314	0.4927	Non-Significant Effect
		11	0.3252	2.407	6	0.1314	0.7204	Non-Significant Effect
		33	-0.2198	2.407	6	0.1314	0.8899	Non-Significant Effect
		100	-1.543	2.407	6	0.1314	0.9964	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	0	1.816	2.802	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.06366271	0.01273254	5	2.137	0.1076	Non-Significant Effect
Error	0.1072697	0.005959425	18			
Total	0.1709324	0.01869197	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	1.407	15.09	0.9236	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9542	0.884	0.3325	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.7835	0.7545	0.8125	0.689	0.876	0.03818	0.07636	9.75%	0.0%
1		4	0.702	0.6682	0.7358	0.578	0.774	0.04445	0.0889	12.66%	10.4%
3.3		4	0.7375	0.7071	0.7679	0.649	0.831	0.03998	0.07996	10.84%	5.87%
11		4	0.7658	0.7381	0.7934	0.702	0.869	0.03633	0.07267	9.49%	2.27%
33		4	0.7955	0.7783	0.8127	0.744	0.853	0.02259	0.04517	5.68%	-1.53%
100		4	0.8678	0.8331	0.9024	0.76	0.952	0.04557	0.09115	10.5%	-10.75%

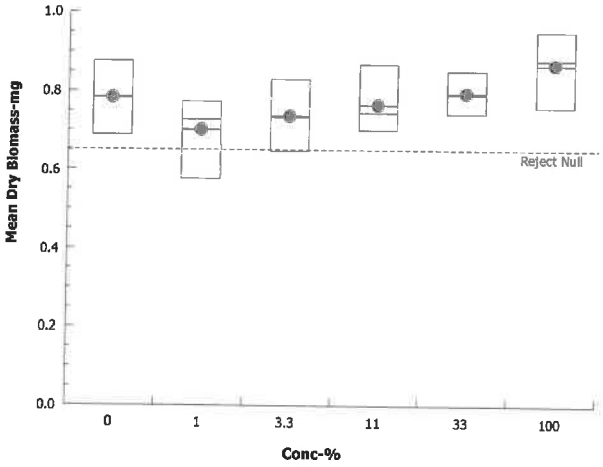
Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

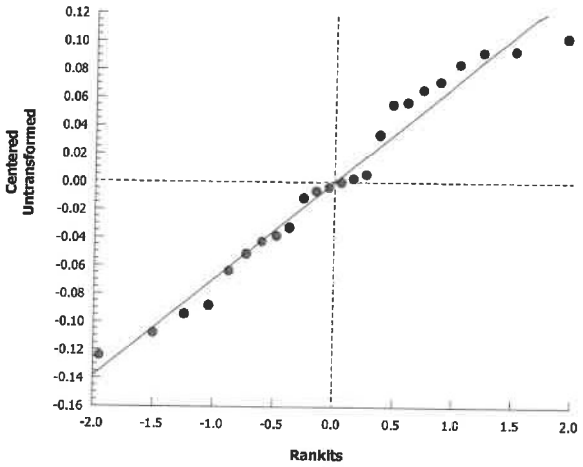
Analysis ID:	11-4303-9384	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:52	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.783	0.689	0.876	0.786
1		0.698	0.578	0.774	0.758
3.3		0.699	0.831	0.649	0.771
11		0.759	0.869	0.733	0.702
33		0.784	0.801	0.853	0.744
100		0.76	0.825	0.952	0.934

Graphics





CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — TestAmerica - ASL

Analysis ID:	13-5518-0232	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:52	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	08-0704-4629	**Test Type:**	Growth-Survival (7d)	**Analyst:**	
Start Date:	30 Jan-18 12:50	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	06 Feb-18 09:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 21h	**Source:**	Aquatox, AR	**Age:**	<48h
Sample ID:	15-0881-8956	**Code:**	B3934-01	**Client:**	
Sample Date:	29 Jan-18 05:05	**Material:**	Unknown	**Project:**	
Receive Date:	30 Jan-18 10:15	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	32h (0.6 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	185691299	200	Yes	Two-Point Interpolation

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value	1.816	2.802	1.0000	No Outliers Detected

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	N/A	N/A	<1	N/A	N/A

Mean Dry Biomass-mg Summary

			Calculated Variate						
Conc-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.7835	0.689	0.876	0.03818	0.07636	9.75%	0.0%
1		4	0.702	0.578	0.774	0.04445	0.0889	12.66%	10.4%
3.3		4	0.7375	0.649	0.831	0.03998	0.07996	10.84%	5.87%
11		4	0.7658	0.702	0.869	0.03633	0.07267	9.49%	2.27%
33		4	0.7955	0.744	0.853	0.02259	0.04517	5.68%	-1.53%
100		4	0.8678	0.76	0.952	0.04557	0.09115	10.5%	-10.75%

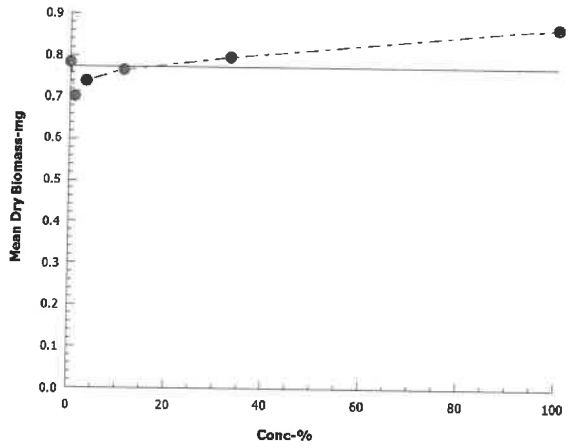
Mean Dry Biomass-mg Detail

Conc-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.783	0.689	0.876	0.786
1		0.698	0.578	0.774	0.758
3.3		0.699	0.831	0.649	0.771
11		0.759	0.869	0.733	0.702
33		0.784	0.801	0.853	0.744
100		0.76	0.825	0.952	0.934

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	13-5518-0232	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.1
Analyzed:	09 Feb-18 10:52	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



APPENDIX B

REFERENCE TOXICANT DATA SHEETS

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: QA / QC

Test Start Date: 1-9-18

Sample Description: NaCl

Initial Sample ID#: 2B0603-06

Data summarized by: MB

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	25	24	0	32	36	32	32	33	30	31	9/9	275
	AD?	AD?	AD? M	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
0.25 g/L	0	19	28	30	28	29	29	32	32	12	9/9	239
	AD? M	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
0.50 g/L	21	22	24	30	22	25	25	26	32	16	10	243
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.0 g/L	24	14	10	22	16	19	24	13	15	11	10	168
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.5 g/L	8	15	16	18	7	9	16	20	20	9	10	139
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
2.0 g/L	0	4	3	0	0	0	0	0	0	0	3	7
	AD? X	AD?	AD?	AD?	AD? X	AD? X	AD? X	AD? X	AD? X	AD? X		
4.0 g/L	0	0	0	0	0	0	0	0	0	0	0	0
	AD? X	AD? X	AD? X	AD? X	AD? X	AD? X	AD? X	AD? X	AD? X	AD? X		

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

Endpoint	IC25	Cusum Chart Limits
Survival	1.67	1.08 to 2.36
Reproduction	0.58	0.26 to 1.33

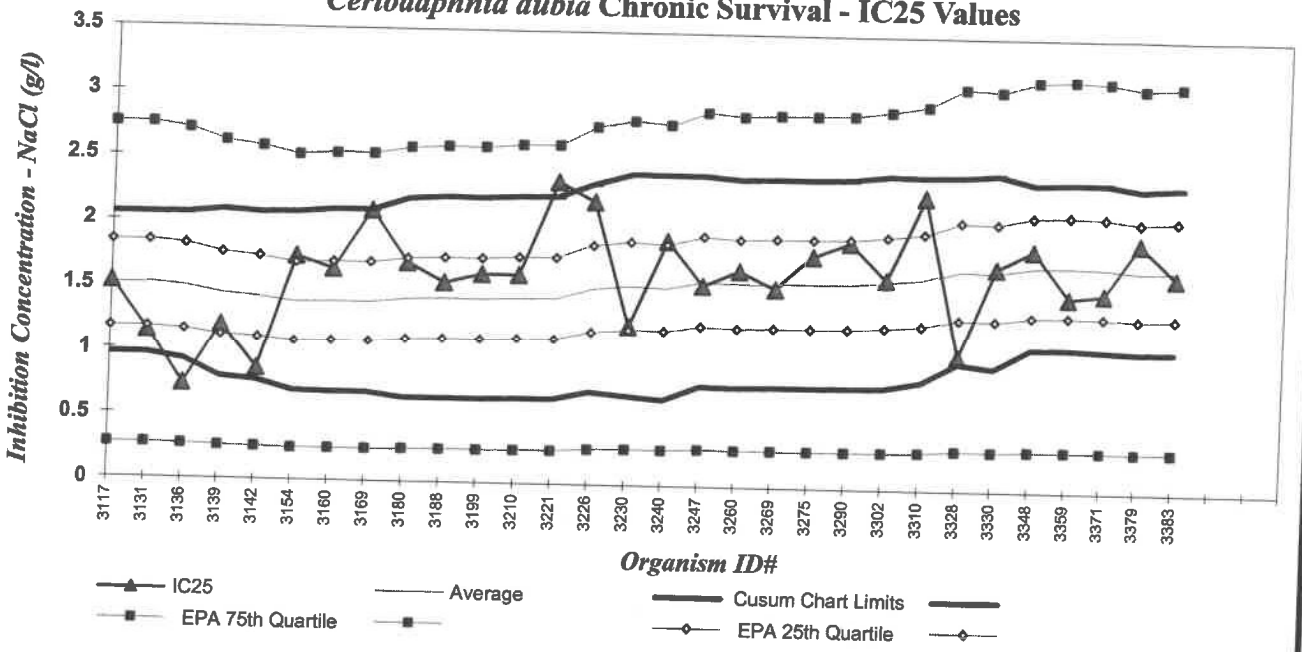
Task Manager: MB

Project Manager: Doug Winn

QA Officer: Ginger Collins

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART

Ceriodaphnia dubia Chronic Survival - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

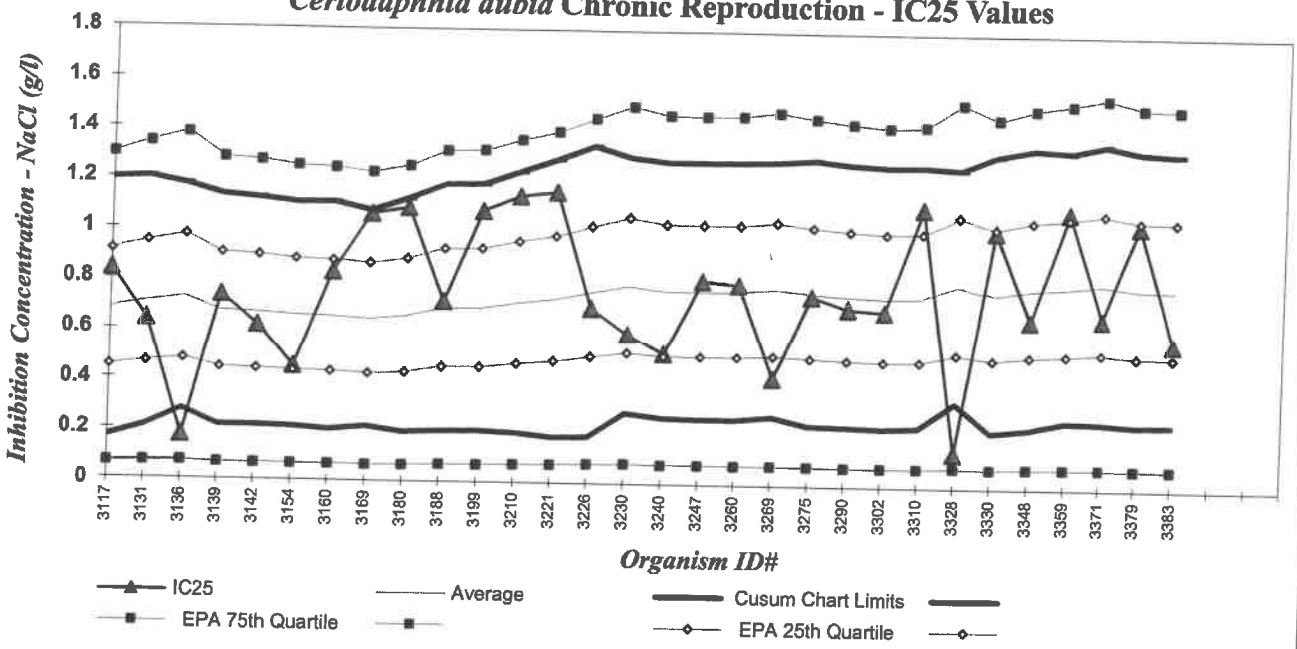
10th Quartile CV (*control limit*) =	0.07
25th Quartile CV (*warning limit*) =	0.11
75th Quartile CV (warning *limit*) =	0.41
90th Quartile CV (*control limit*) =	0.81

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
316	3328	07/20/17	1.04	1.70	0.36	**0.98**	**2.43**	0.22
317	3330	08/01/17	1.73	1.70	0.37	**0.95**	**2.45**	0.18
318	3348	09/07/17	1.87	1.74	0.32	**1.10**	**2.38**	0.18
319	3359	10/03/17	1.51	1.75	0.32	**1.11**	**2.39**	0.19
320	3371	11/07/17	1.54	1.74	0.32	**1.09**	**2.39**	0.18
321	3379	12/12/17	1.93	1.71	0.32	**1.08**	**2.34**	0.19
322	3383	01/09/18	1.67	1.72	0.32	**1.08**	**2.36**	0.18
323								
324								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART

Ceriodaphnia dubia **Chronic Reproduction - IC25 Values**



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Reproduction

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.08

25th Quartile CV (*warning limit*) = 0.17

75th Quartile CV (warning *limit*) = 0.45

90th Quartile CV (*control limit*) = 0.62

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
318	3348	9/7/2017	0.67	0.79	0.28	**0.24**	**1.35**	0.33
319	3359	10/3/2017	1.10	0.80	0.27	**0.27**	**1.34**	0.34
320	3371	11/7/2017	0.68	0.82	0.28	**0.26**	**1.37**	0.34
321	3379	12/12/2017	1.05	0.80	0.27	**0.25**	**1.34**	0.34
322	3383	1/9/2018	0.58	0.79	0.27	**0.26**	**1.33**	0.35
323								
324								

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: QA / QC Test Start Date: 2-27-2018

Sample Description: NaCl Initial Sample ID#: 2B063-06

Data summarized by: DW

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	32	14	31	31	36	31	32	25	31	30	10	293
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
0.25 g/L	28	28	35	24	28	28	30	30	19	28	10	278
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
0.50 g/L	26	30	29	30	22	27	26	29	23	22	10	264
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.0 g/L	18	8	22	23	0	21	16	15	19	11	9	153
	AD?	AD?	AD?	AD?	AD? ✓	AD?	AD?	AD?	AD?	AD?		
1.5 g/L	10	7	8	2	2	10	1	9	10	8	9	67
	AD?	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD?	AD?	AD?		
2.0 g/L	0	0	1	0	0	1	0	0	0	1	5	3
	AD?	AD? ✓	AD?	AD?	AD?	AD?	AD? ✓	AD? ✓	AD? ✓	AD? ✓		
4.0 g/L	0	0	0	0	0	0	0	0	0	0	0	0
	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓		

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

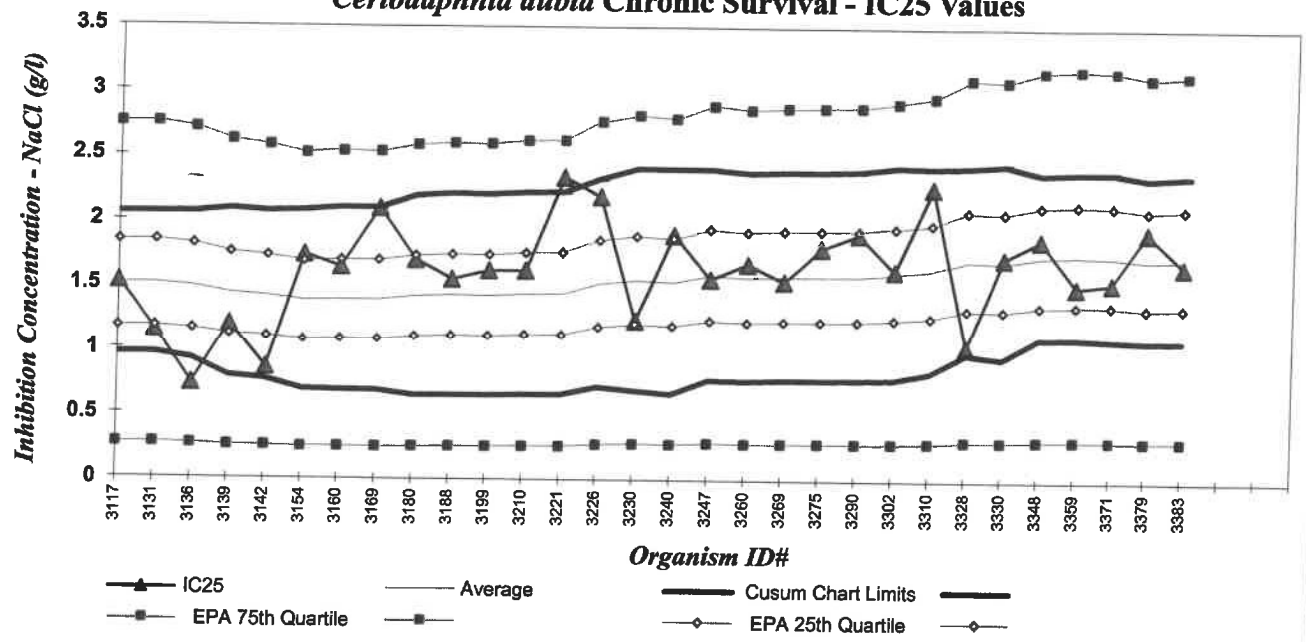
Endpoint	IC25	Cusum Chart Limits
Survival	1.68	1.06 to 2.37
Reproduction	0.68	0.16 to 1.33

Task Manager: Doug Wilson

Project Manager:

QA Officer: Ginger Collins

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART
Ceriodaphnia dubia Chronic Survival - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

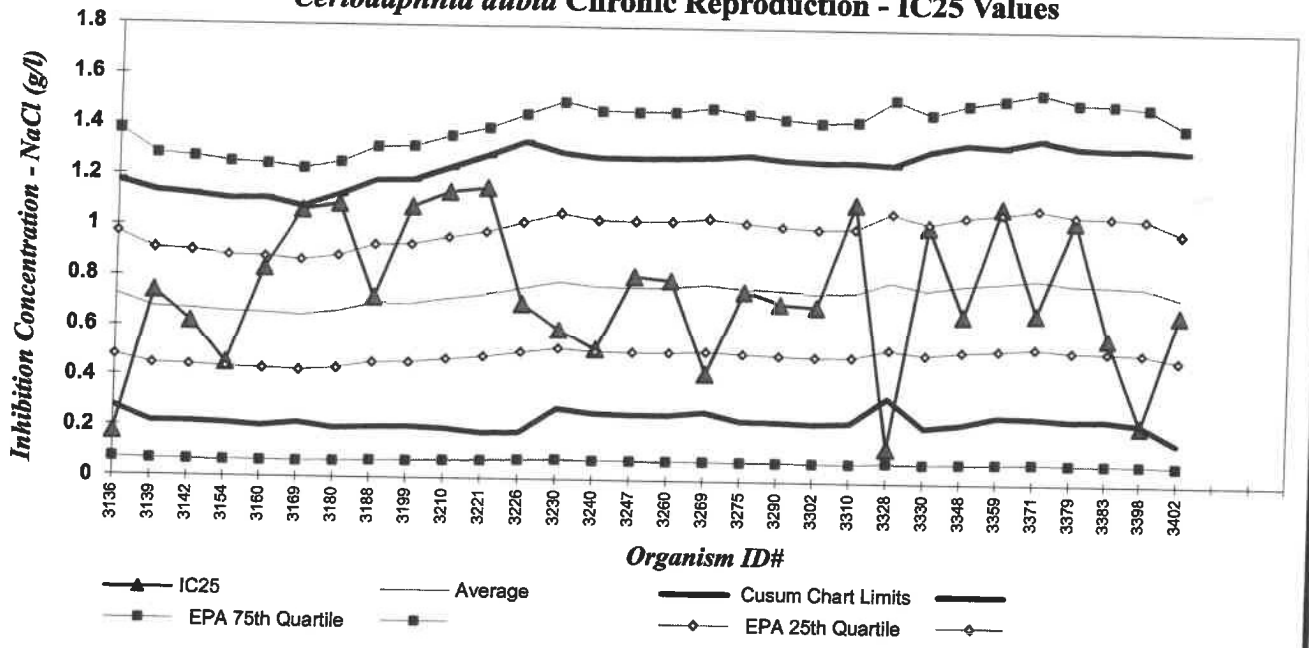
From EPA 833-R-00-003:

10th Quartile CV (*control limit*) =	0.07
25th Quartile CV (*warning limit*) =	0.11
75th Quartile CV (warning *limit*) =	0.41
90th Quartile CV (*control limit*) =	0.81

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
316	3328	07/20/17	1.04	1.70	0.36	**0.98**	**2.43**	0.22
317	3330	08/01/17	1.73	1.70	0.37	**0.95**	**2.45**	0.18
318	3348	09/07/17	1.87	1.74	0.32	**1.10**	**2.38**	0.18
319	3359	10/03/17	1.51	1.75	0.32	**1.11**	**2.39**	0.19
320	3371	11/07/17	1.54	1.74	0.32	**1.09**	**2.39**	0.18
321	3379	12/12/17	1.93	1.71	0.32	**1.08**	**2.34**	0.19
322	3383	01/09/18	1.67	1.72	0.32	**1.08**	**2.36**	0.18
323	3398	02/06/18	1.36	1.73	0.32	**1.10**	**2.36**	0.19
324	3402	02/27/18	1.68	1.72	0.33	**1.06**	**2.37**	0.19

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART
Ceriodaphnia dubia Chronic Reproduction - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Reproduction

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) =	0.08
25th Quartile CV (*warning limit*) =	0.17
75th Quartile CV (warning *limit*) =	0.45
90th Quartile CV (*control limit*) =	0.62

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
318	3348	9/7/2017	0.67	0.79	0.28	**0.24**	**1.35**	0.33
319	3359	10/3/2017	1.10	0.80	0.27	**0.27**	**1.34**	0.34
320	3371	11/7/2017	0.68	0.82	0.28	**0.26**	**1.37**	0.34
321	3379	12/12/2017	1.05	0.80	0.27	**0.25**	**1.34**	0.34
322	3383	1/9/2018	0.58	0.79	0.27	**0.26**	**1.33**	0.35
323	3398	2/6/2018	**0.23**	0.79	0.27	**0.24**	**1.33**	0.39
324	3402	2/27/2018	0.68	0.75	0.29	**0.16**	**1.33**	0.38

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 2
Stock Sol. ID: Z B 0 6 8 - 02
Organism ID: FHM 1961
Waterbath/incubator Used: # 7
Date Initiated: 1/17/2018 Time: 11:35
Date Terminated: 1/24/2018 Time: 08:35
Test Container Size: 800 ml
Solution Volume / rep: 500 ml
Client: QA / QC - RefTox
Sample Description: KCl (50 g/L stock)

Tech: Day 0 NB/BM Day 1 [illegible] Day 2 [illegible] Day 3 MB/[illegible] Day 4 NB Day 5 NB Day 6 BM Day 7 NB
Time: Day 0 1125 Day 1 1150 Day 2 1250 Day 3 1310 Day 4 1335 Day 5 1425 Day 6 1155 Day 7 0835

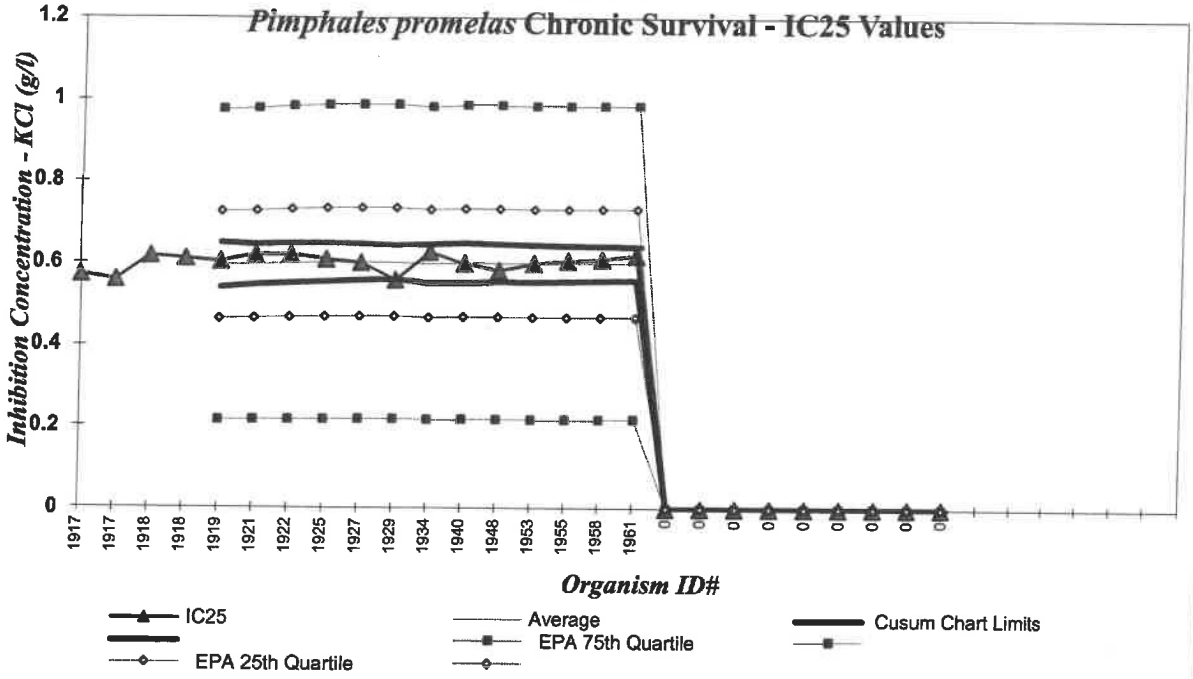
Conc. or Percent	Day	Number of Live Organisms A	B	C	D	Dissolved O_2 (mg/l) Pre	Post	pH Pre	Post	Temp. (°C) Pre	Therm. ID #	Conductivity (µS) Post (daily)
Control	0	10	10	10	10		7.6		7.8	Post: 24.3	254	295
	1	10	10	10	10	6.5	7.8	7.2	8.0	24.5	254	295
	2	10	10	10	10	5.8	7.3	7.3	8.1	24.3	251	298
	3	10	10	10	10	6.2	6.7	7.3	8.1	24.3	255	332
	4	10	10	10	10	7.0	7.3	7.9	8.2	24.3	254	337
	5	10	10	10	10	7.2	7.1	7.7	8.1	24.0	254	340
	6	10	10	10	10	7.0	7.9	7.6	8.2	24.3	255	346
	7	10	10	10	10	6.4		7.3		24.2	256	
0.25 g/L	0	10	10	10	10		7.8		7.9	Post: 24.4		772
	1	10	10	10	10	6.6	7.8	7.1	8.0	24.5		805
	2	10	10	10	10	5.9	7.5	7.4	8.1	24.4		837
	3	10	10	10	10	6.3	7.1	7.2	8.1	24.3		823
	4	10	10	10	10	7.0	7.5	7.8	8.3	24.1		867
	5	10	10	10	10	6.9	7.7	7.5	8.1	24.0		812
	6	10	10	10	10	7.0	8.0	7.6	8.2	24.0		794
	7	10	10	10	10	6.6		7.4		24.1		
0.50 g/L	0	10	10	10	10		7.8		8.0	Post: 24.3		1292
	1	10	10	10	10	6.4	7.8	7.1	8.0	24.4		1166
	2	10	10	10	10	6.0	7.5	7.4	8.1	24.3		1286
	3	10	9	10	10	6.4	7.4	7.3	8.2	24.3		1350
	4	9	9	10	10	7.0	7.5	7.8	8.3	24.1		1299
	5	9	9	10	10	6.7	7.8	7.5	8.2	24.0		1306
	6	9	9	10	10	6.8	8.1	7.6	8.3	24.1		1289
	7	9	9	10	10	6.6		7.4		24.1		
1.0 g/L	0	10	10	10	10		7.8		8.0	Post: 24.3		2180
	1	6	4	6	10	6.3	7.9	7.1	8.0	24.4		2100
	2	6	3	6	8	6.2	7.5	7.4	8.1	24.3		2110
	3	4	2	5	6	6.4	7.5	7.3	8.2	24.3		2150
	4	4	2	3	3	7.0	7.7	7.7	8.3	24.3		2160
	5	3	1	1	3	6.7	7.9	7.5	8.2	24.1		2150
	6	3	1	1	3	6.6	8.2	7.6	8.3	24.0		2250
	7	3	1	1	3	6.6		7.5		24.2		
2.0 g/L	0	10	10	10	10		7.9		8.1	Post: 24.3		3830
	1	0	0	0	0	6.3		7.1		24.3		
	2											
	3											
	4											
	5											
	6											
	7											
4.0 g/L	0	10	10	10	10		8.0		8.1	Post: 24.3		7060
	1	0	0	0	0	6.5		7.1		24.5		
	2											
	3											
	4											
	5											
	6											
	7											

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.
Pre = Pre-renewal solutions. Post = Post-renewal solutions.
Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
(23.8) = Temp. out of recommended range

Endpoint	IC25	Cusum Chart Limits
Survival	0.62	0.56 to 0.64
Growth	0.57	0.44 to 0.72

Task Manager
Project Manager
QA Officer Ginger Collins

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



Pimephales promelas **- Chronic (EPA Test Method 1000.0)**

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.03

25th Quartile CV (*warning limit*) = 0.11

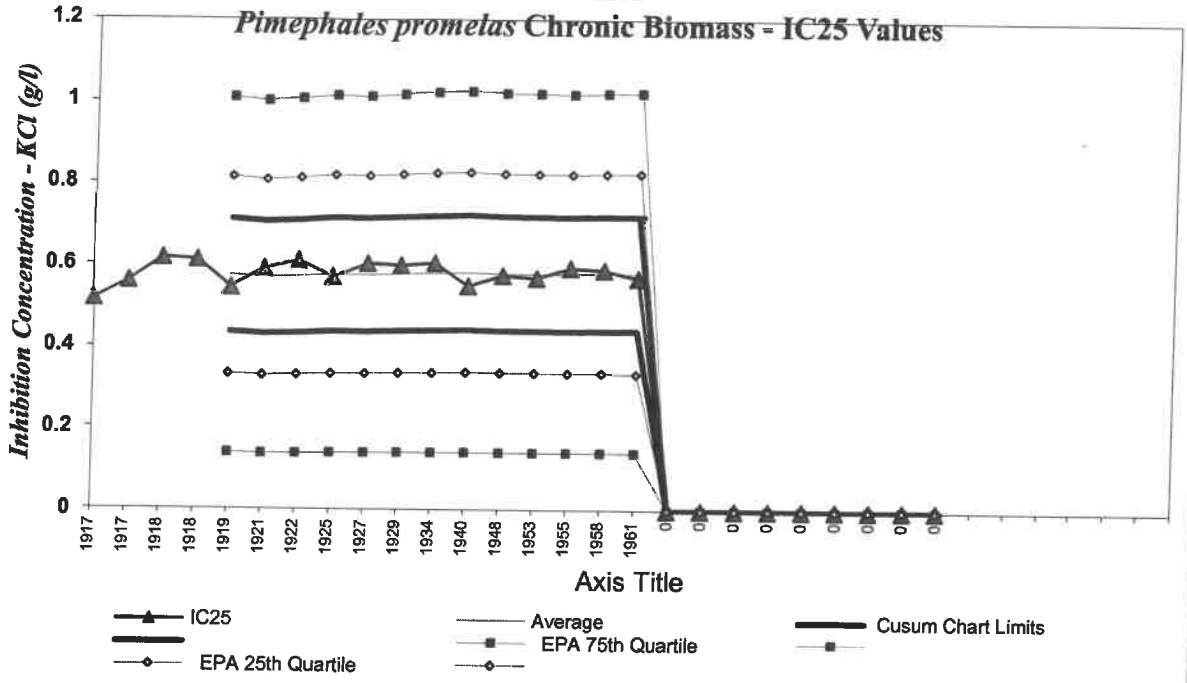
75th Quartile CV (*warning limit*) = 0.32

90th Quartile CV (*control limit*) = 0.52

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	FHM ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
6	1919	03/28/17	**0.60**	0.60	0.03	**0.54**	**0.65**	0.05
7	1921	04/04/17	**0.62**	0.6	0.02	**0.55**	**0.65**	0.04
8	1922	04/11/17	**0.62**	0.6	0.02	**0.55**	**0.65**	0.04
9	1925	05/09/17	**0.61**	0.60	0.02	**0.56**	**0.65**	0.04
10	1927	06/13/17	**0.60**	0.6	0.02	**0.56**	**0.65**	0.04
11	1929	06/20/17	**0.56**	0.6	0.02	**0.56**	**0.64**	0.03
12	1934	07/20/17	**0.63**	0.6	0.02	**0.55**	**0.65**	0.04
13	1940	08/01/17	**0.60**	0.6	0.02	**0.55**	**0.65**	0.04
14	1948	09/12/17	**0.58**	0.6	0.02	**0.56**	**0.65**	0.04
15	1953	10/10/17	**0.60**	0.6	0.02	**0.56**	**0.65**	0.04
16	1955	11/07/17	**0.61**	0.6	0.02	**0.56**	**0.64**	0.04
17	1958	12/12/17	**0.61**	0.6	0.02	**0.56**	**0.64**	0.04
18	1961	01/17/18	**0.62**	0.6	0.02	**0.56**	**0.64**	0.03
19								
20								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



Pimephales promelas - Chronic (EPA Test Method 1000.0)

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Growth (Biomass)

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.12

25th Quartile CV (*warning limit*) = 0.21

75th Quartile CV (*warning limit*) = 0.38

90th Quartile CV (*control limit*) = 0.45

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	FHM ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
7	1921	4/4/2017	**0.59**	0.6	0.04	**0.43**	**0.71**	0.07
8	1922	4/11/2017	**0.61**	0.6	0.04	**0.43**	**0.71**	0.06
9	1925	5/9/2017	**0.57**	0.58	0.04	**0.44**	**0.72**	0.06
10	1927	6/13/2017	**0.60**	0.58	0.03	**0.44**	**0.71**	0.06
11	1929	6/20/2017	**0.60**	0.58	0.03	**0.44**	**0.72**	0.06
12	1934	7/20/2017	**0.61**	0.58	0.03	**0.44**	**0.72**	0.06
13	1940	8/1/2017	**0.55**	0.58	0.03	**0.44**	**0.72**	0.05
14	1948	9/12/2017	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
15	1953	10/10/2017	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
16	1955	11/7/2017	**0.59**	0.58	0.03	**0.44**	**0.72**	0.05
17	1958	12/12/17	**0.59**	0.58	0.03	**0.44**	**0.72**	0.05
18	1961	01/17/18	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
19								
20								
21								
22								

APPENDIX C

CHAIN OF CUSTODY

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3934 A

Client/Project: Energy Northwest

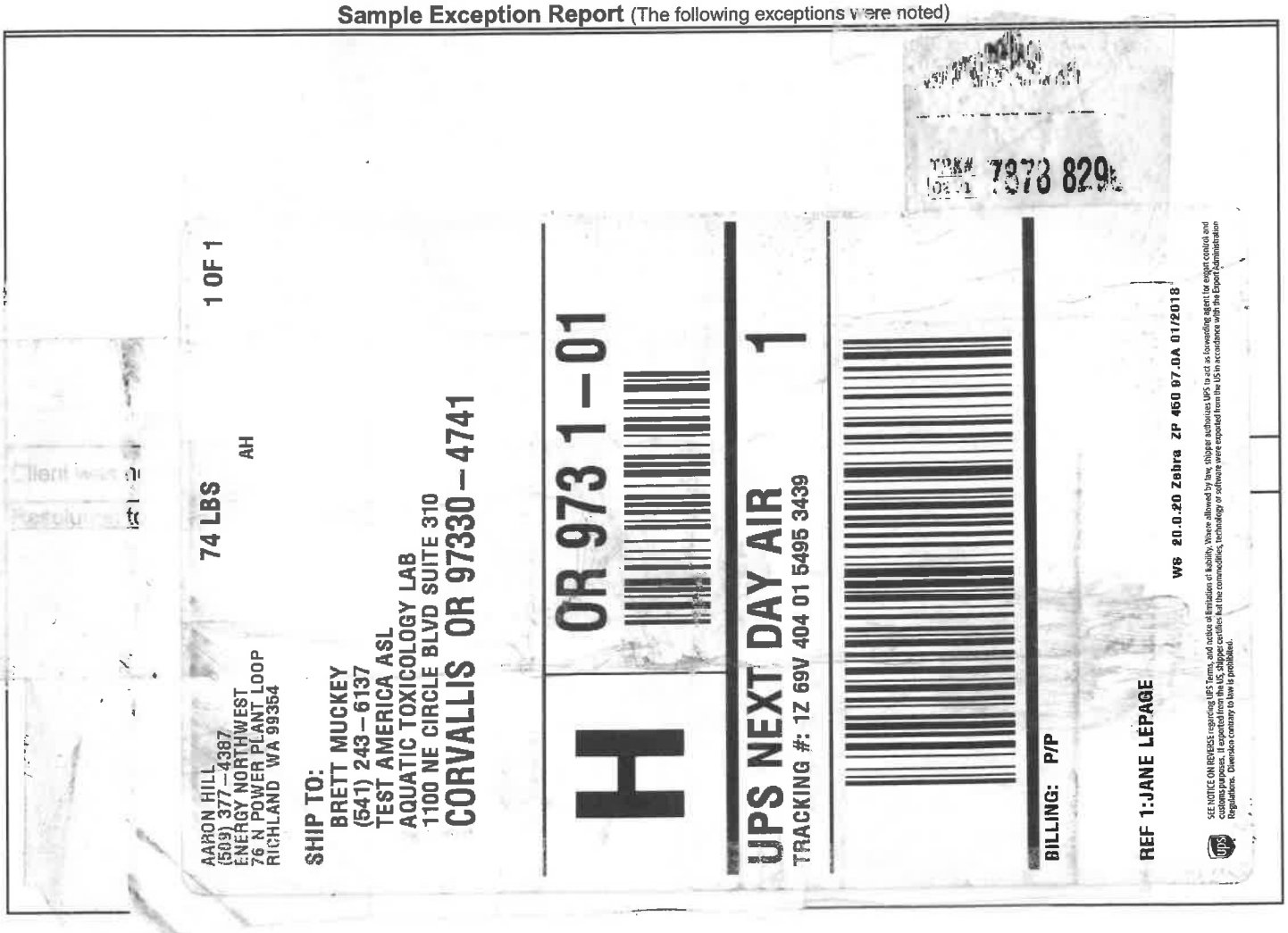
Date Received: 1/30/18

Received By: PC

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 4/18/18	0.6 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?		☒ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)		☒ Yes	☐ No	☐ N/A
Were the sample containers in good condition (not broken or leaking)?		☒ Yes	☐ No	☐ N/A
Are all samples within 36 hours of collection?		☒ Yes	☐ No	☐ N/A

Method of Shipment: ☐ Hand Delivered ☐ FedEx ☒ UPS ☐ Greyhound ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client Energy Northwest
Address PO Box 968
Richland WA 99352

Contact Person: Jane LePage
Phone: 509-377-4061

Project # Contract 344765

NPDES# WA 0025515-1
Composite Sample Information
Samples/Hour ____ Volume/Sample 10 L
Total Hours ____ Total Volume 20L, Grab
Initiated: Date ____ Time ____
Ended: Date 012918 Time 05:05
Chilled During Collection 4

Ship Samples to:
PO#

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N) ____
Temp. Upon Arrival (°C) ____
Check Ammonia (Y/N) ____ Dechlorinated (Y/N) ____

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
1807870 1	012918	0505		X	2		X	X		X														See attached
																								except from permit.
																								Re: Chronic tests.
																								Acute - Fathead
																								minnow 96 hr
																								Static renewal
																								EPA-821-R-02-012

Sampled By & Title (Please sign and print name) Jane LePage Env. Scientist	Date/Time 012918 / 0505	Relinquished By (Please sign and print name) Jane LePage	Date/Time 012918 1230
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name) TA ASL	Date/Time 1/30/18 1015	Shipped Via (UPS) Bis Fed-Ex Hand Other	Shipping #
Work Authorized By (Please sign and print name)	Remarks Sealed Cooler delivered to Shipping dept. B 3934 A ice 0.6°C		

COC_Bioassay
Doc Control ID: ASL612-0717

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3934 B
Client/Project: Energy NW

Date Received: 2/1/18
Received By: AC

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☑ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 4/18/18	0.7 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out (If No, document below)	☑ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☑ Yes	☐ No	☐ N/A	

Method of Shipment: ☐ Hand Delivered ☐ FedEx ☐ UPS ☒ Greyhound ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352

Contact Person: Jane LePage
Phone: 509.377.4061

Project #: Contract 344765

NPDES# WA002515-1
Composite Sample Information
Samples/Hour
Total Hours
Initiated: Date Time
Ended: Date 013118 Time 0500
Chilled During Collection Y

Ship Samples to:
PO#

Volume/Sample
Total Volume 20L

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N)
Temp. Upon Arrival (°C)
Check Ammonia (Y/N)
Dechlorinated (Y/N)

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
180787.02	013118	0500		X	2			X		X														2nd Sample for Chron. 2 testing EPA-821-R-02-013

Sampled By & Title (Please sign and print name): Jane LePage Env. Scientist — Date/Time: 013118 0500

Relinquished By (Please sign and print name): Jane LePage — Date/Time: 013118 1230

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): — Date/Time:

Relinquished By (Please sign and print name): — Date/Time:

Received By (Please sign and print name): Patti Cowan for TA ASL — Date/Time: 01/18 1000

Shipped Via: (UPS) Bis Fed-Ex Hand Other — Shipping #:

Work Authorized By (Please sign and print name):

Remarks: Sealed cooler delivered to shipping dept.

COC_Bioassay
Doc Control ID: ASL612-0717

B3934 B ICE ODS: 0.3°C
COR: 0.7°C

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3934-03

Client/Project: Energy NW

Date Received: 2-3-18

Received By:

Were custody seals intact?			☒ Yes	☐ No	☐ N/A	
Packing Material:			☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 4-18-18	0.6 °C		☒ Yes	☐ No	☐ N/A	
Was a Chain of Custody (CoC) Provided?			☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out (If No, document below)			☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?			☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?			☒ Yes	☐ No	☐ N/A	
Method of Shipment:	☐ Hand Delivered	☐ FedEx	☒ UPS	☐ Greyhound	☐ Other: _____	☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352
Contact Person: Jane LePage
Phone: 509.377.4061
Project #: Contract 344765

NPDES#: WA 002515-1
Composite Sample Information:
Samples/Hour:
Total Hours:
Initiated: Date: Time:
Ended: Date: 020218 Time: 0510
Chilled During Collection: Y

Ship Samples to:
PO#:

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

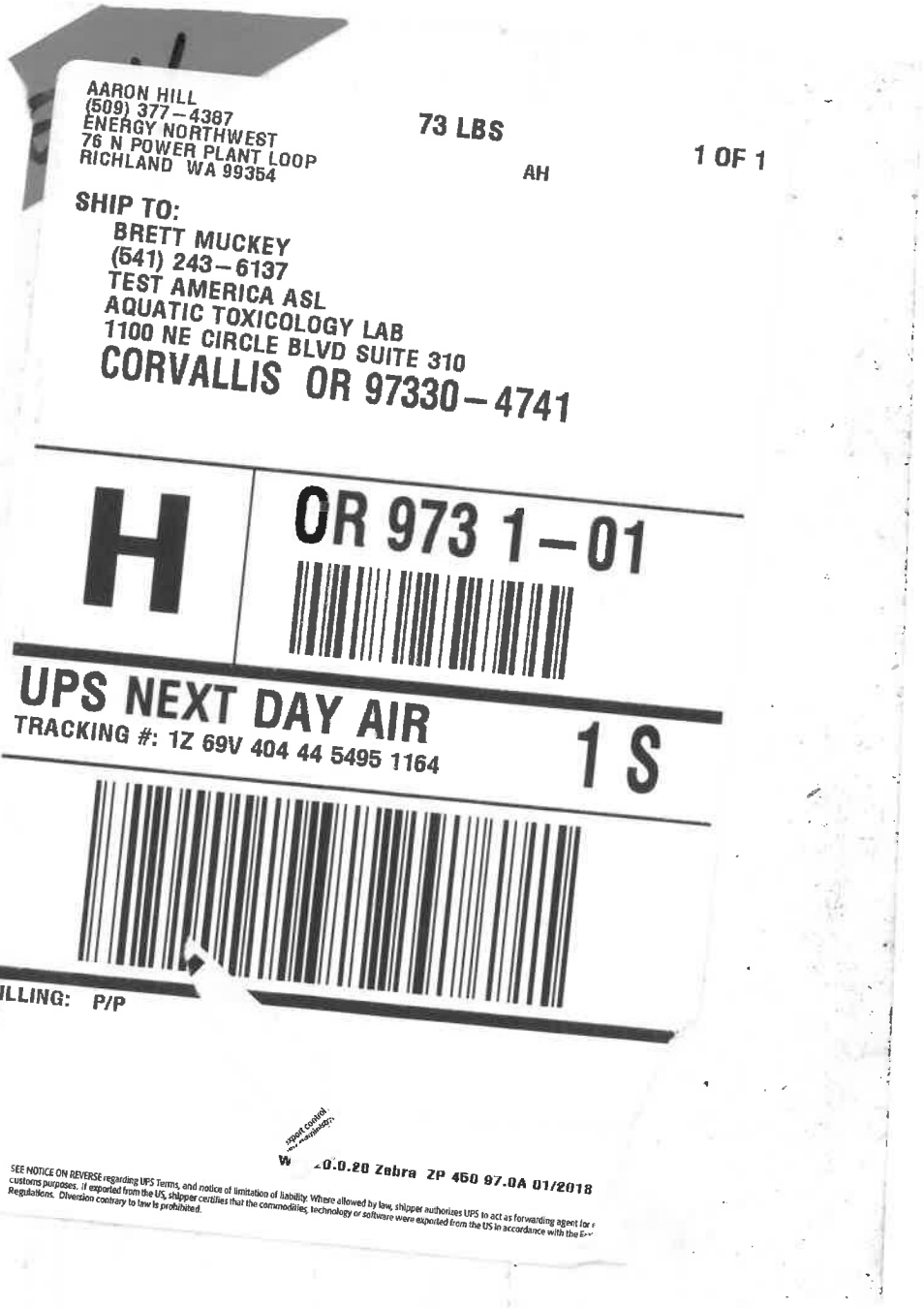
Volume/Sample:
Total Volume: 20L

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste	Analysis Required / Comments: Concentration and/or Comments
180787-03	020218	0510		X	2	B3534.03		X		X											3rd Sample for Chronic Tox test. EPA-821-R-02-013

Sampled By & Title (Please sign and print name): Jane LePage Env. Scientist	Date/Time: 020218 0510	Relinquished By (Please sign and print name): Jane LePage	Date/Time: 020218 1230
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name): JA ASL	Date/Time: 2/3/18 0925	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #:
Work Authorized By (Please sign and print name):	Remarks: Sealed Cooler delivered to Shipping Dept		

COC_Bioassay
Doc Control ID: ASL612-0717



AARON HILL
(509) 377–4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

73 LBS

AH

1 OF 1

SHIP TO:
BRETT MUCKEY
(541) 243–6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330–4741

H

OR 973 1–01

UPS NEXT DAY AIR

TRACKING #: 1Z 69V 404 44 5495 1164

1 S

BILLING: P/P

Import control

W 0.0.20 Zebra ZP 450 97.0A 01/2018

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TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING RDL MB 2-27-18

Sample Receipt Record

Batch Number: B 3954 BA (-01)

Client/Project: Energy NW

Date Received: PC

Received By: 2/27/18 D

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 4/18/18	3.1 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	

Method of Shipment: ☐ Hand Delivered ☐ FedEx ☐ UPS ☒ Greyhound ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352

Contact Person: Jane LePage
Phone: 509-377-4061

Project #:

NPDES#: WA002515-1
Composite Sample Information:
Samples/Hour:
Total Hours:
Initiated: Date: Time:
Ended: Date: 022618 Time: 0530
Chilled During Collection: Y

Volume/Sample:
Total Volume: 4L

Ship Samples to:
PO#:

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Entry error JL 022618 Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
~~180781-01~~	022618	0530		X	1	B39549				X														
180871-01																								Chronic toxicity test per EPA-821-R-02-013

Sampled By & Title (Please sign and print name): Jane LePage Environmental Scientist	Date/Time: 022618/0530	Relinquished By (Please sign and print name): Jane LePage	Date/Time: 022618 1230
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name): TA ASL	Date/Time: 022718 1115	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #:
Work Authorized By (Please sign and print name):	Remarks: Sealed cooler delivered to shipping dept.		

COC_Bioassay
Doc Control ID: ASL612-0717

B 3954 AB ICE COR: 3.1°C
Rec'd WB 2-27-19 ODS: 2.4°C

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3954B
Date Received: 3/1/18
Client/Project: Energy NW
Received By: PC

Were custody seals intact?	☒ Yes ☐ No ☐ N/A	
Packing Material:	☒ Ice ☐ Blue Ice ☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 4/18/18	0.3 °C	☒ Yes ☐ No ☐ N/A
Was a Chain of Custody (CoC) Provided?		☒ Yes ☐ No ☐ N/A
Was the CoC correctly filled out (If No, document below)		☒ Yes ☐ No ☐ N/A
Were the sample containers in good condition (not broken or leaking)?		☒ Yes ☐ No ☐ N/A
Are all samples within 36 hours of collection?		☒ Yes ☐ No ☐ N/A

Method of Shipment: ☐ Hand Delivered ☐ FedEx ☒ UPS ☐ Greyhound ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352

Contact Person: Jane LePage
Phone: 509.377.4061

Project #

NPDES# WA 002515-1
Composite Sample Information

Samples/Hour
Total Hours
Initiated: Date Time
Ended: Date 022818 Time 0527
Chilled During Collection Y

Ship Samples to:
PO#

Volume/Sample
Total Volume 4L

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N)
Temp. Upon Arrival (°C)
Check Ammonia (Y/N) Dechlorinated (Y/N)

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
							Analysis Required / Comments																	
180871-02	022818	0527		X	1	B3954-02				X														

Sampled By & Title (Please sign and print name) Jane LePage Env. Scientist	Date/Time 022818 0527	Relinquished By (Please sign and print name) Jane LePage	Date/Time 022818 1230
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name) TA Asst.	Date/Time 3/1/18 1030	Shipped Via (UPS) Bis Fed-Ex Hand Other	Shipping #
Work Authorized By (Please sign and print name)	Remarks Sealed Cooler delivered to shipping department		

B3954 B 0831: 0.6°C
COR: 0.5°C

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3954-03
Client/Project: Energy NW

Date Received: 3-3-18 @ 0915
Received By: D. WINN

Were custody seals intact?	☒ Yes ☐ No ☐ N/A	
Packing Material:	☒ Ice ☐ Blue Ice ☐ Box	
Temp OK? (<6C) Therm ID: ~~TH173~~ DW Exp. Therm. # 257	1.1 °C ☐ Yes ☐ No ☐ N/A	
Was a Chain of Custody (CoC) Provided?	☒ Yes ☐ No ☐ N/A	
Was the CoC correctly filled out (If No, document below)	☒ Yes ☐ No ☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes ☐ No ☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes ☐ No ☐ N/A	
Method of Shipment:	☐ Hand Delivered ☐ FedEx ☒ UPS ☐ Greyhound ☐ Other: _____ ☐ N/A	

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968, Richland WA 99352
Contact Person: Jane LePage
Phone: 509-377-4061
Project #: Contract 344765

NPDES#: WA 002515-1
Composite Sample Information:
Samples/Hour: Volume/Sample:
Total Hours: Total Volume:
Initiated: Date: Time:
Ended: Date: 030218 Time: 0529
Chilled During Collection: Y

Ship Samples to:
PO#:

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C): 1.1°C
Check Ammonia (Y/N): Dechlorinated (Y/N):

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste	Analysis Required / Comments: Concentration and/or Comments
180871-03	030218	0529		X	1					X											3rd Sample for chronic test (renewal) EPA-821-R-02-013

180871-03
Customer: ENW-Reg
Customer #: CW grab-3
Site: CW
Date: 030218 0529 JR

Sampled By & Title (Please sign and print name): Jane LePage Jane LePage Env. Scientist	Date/Time: 030218 0529	Relinquished By (Please sign and print name): Jane LePage	Date/Time: 030218 0900
Received By (Please sign and print name): Doug Wynn/LAB 3-3-18/0915	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #:
Work Authorized By (Please sign and print name):	Remarks: Sealed Cooler delivered to shipping dept. JR		

B3954-03

AARON HILL
(509) 377–4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

24 LBS

1 OF 1

SHIP TO:
BRETT MUCKEY
(541) 243–6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330–4741

OR 973 1–01

UPS NEXT DAY AIR **1 S**

TRACKING #: 1Z 69V 404 44 5638 9359

BILLING: P/P

REF 1:lapage

SEE NOTICE ON REVERSE regarding UPS customs purposes. If exported from the Regulations. Diversion contrary to law

1 control and dministration

1Z69V4044456381200 9359 □ APOW-5030

P: S: I:

TEST AMERICA ASL
1100 NE CIRCLE BLVD
STE 310
CORVALLIS OR 97330-4254

TestA THE LEADER IN EN

BIOASSAY REPORT

CHRONIC
BIOASSAYS CONDUCTED
May 1 through May 10, 2018

Prepared for

ENERGY NORTHWEST
RICHLAND, WASHINGTON

Prepared by

ASL

1100 NE Circle Boulevard, Suite 310
Corvallis, Oregon 97330
541-207-0995

NELAC #OR100022
State of Washington Department of Ecology (WDOE), Lab ID C1233
California State Environmental Laboratory Accreditation Program, Certificate No.: 1726

Revision 1 Report Date: June 6, 2018
Original Report Date: May 25, 2018
Lab I.D. No. B3990-chr

CONTENTS

INTRODUCTION

TestAmerica ASL (TA-ASL) – Bioassay Laboratory conducted chronic bioassays using the *Pimephales promelas* (fathead minnow) and the water flea (*Ceriodaphnia dubia*), on samples provided by Energy Northwest, Richland, Washington. The tests were conducted from May 1 through May 10, 2018.

Please note that the *P. promelas* scheduled to be used on May 1 did not arrive as planned (shipping issue). New organisms were ordered and the *P. promelas* test was initiated with the May 2 sample on May 3, 2018.

Also note that acute testing using the *Ceriodaphnia dubia* (water flea) was also initiated at this time. As per client request, the acute results will be reported separately.

The original report was issued on May 25, 2018. Revision 1 of the report was issued to address editorial comments made of the original report.

OVERVIEW OF REGULATORY GUIDANCE

The following provides an overview and excerpts of applicable permit specifics, regulatory guidance, and other relevant information. This is intended only as a helpful guide, from a laboratory perspective, for understanding test outcomes. The final responsibility for interpretation of results remains with the client and/or regulatory agency.

The following guidance is taken from TA-ASL's reading of the NPDES permit for Energy Northwest's Columbia Generating Station in Richland, WA (permit #WA002515-1, effective Nov 1, 2014, expires Oct 31, 2019, modified Feb 8, 2016).

Chronic toxicity:

Testing:

- "Conduct chronic toxicity testing … once per quarter in the year prior to submission of the application for permit renewal."
- "Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 11% effluent. The series of dilutions should also contain the CCEC of 1% effluent."
- "The CCEC equals 1% effluent."

Sampling and Reporting Requirements:

- "The permittee must collect grab samples … must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion."
- "The lab must begin the toxicity testing … no later than 36 hours after sampling was completed."
- "The Permittee must chemically dechlorinate final effluent … with sodium thiosulfate just prior to test initiation. Do not add more sodium thiosulfate than is necessary to neutralize the chlorine. Provide in the test report the calculations to determine the amount of sodium thiosulfate necessary …"

The following is taken from the WDOE guidance (WQ-R-95-80, June 2016 revision):

"To reduce WET limit violations (and anomalous concentration-response relationships) due to statistical significance that is a Type I error [false positive], we lower alpha when differences in test organism response are small."

"Alpha will be lowered from 0.05 to 0.01 if a … 20% difference in a chronic test is significant."

SUMMARY OF TEST RESULTS

Exhibit 1 provides a summary of the final test results.

EXHIBIT 1
Summary of Chronic Test Results

Species	NOEC (%)	LOEC (%)	IC_{25} (%)
C. dubia	33.0	100	53.6
P. promelas	100	> 100	> 100

Note: acronyms are as defined below.

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

More detailed information is provided in the Results and Discussion section.

ACRONYM DEFINITIONS (from EPA guidance):

NOEC = No Observed Effect Concentration: The highest test concentration that causes no observable adverse effects on the test organisms (i.e. no statistically significant reduction from the control).
LOEC = Low Observed Effect Concentration: The lowest test concentration that does cause an observable adverse effect on the test organisms (i.e. is statistically significant reduction from the control).

IC_{25} = Inhibition Concentration (25%): A point estimate of the test concentration that would cause a 25 percent reduction of a non-quantal biological measurement (i.e. growth, reproduction, etc.) for the test population.

SAMPLE INFORMATION

Exhibit 2 provides a summary of the sample conditions as received.

EXHIBIT 2
Sample Conditions on Receipt

Sample ID				
TA-ASL SDG + suffix	B3990 -01	B3990 -02	B3990 -03	B3990 -04
Collection - Date and Time	04/30/2018 05:27	05/02/2018 05:20	05/04/2018 05:15	05/07/2018 05:15
Receipt - Date and Time	05/01/2018 10:30	05/03/2018 10:30	05/05/2018 12:20	05/08/2018 10:35
Temperature (^oC)	2.7	2.2	3.1	3.6
Dissolved Oxygen (mg/L)	8.4	10.0	9.5	8.4
pH	7.2	7.8	7.9	8.0
Conductivity (S/cm)	1430	1392	1415	1436
Total Residual Chlorine (mg/L)	0.04 [a]	0.06 [a]	0.04 [a]	0.04 [a]
Ammonia (mg/L as NH_3-N)	< 0.10	< 0.10	< 0.10	< 0.10
Total Hardness (mg/L as $CaCO_3$)	354	760	795	830
Total Alkalinity (mg/L as $CaCO_3$)	110	104	135	120

Water quality measurements during testing remained within test design limits as prescribed by EPA and WDOE, except as noted with the individual test results. (see the Results and Discussion section)

METHODS AND MATERIALS

TEST METHODS

The chronic test methods were performed according to: *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, (2002), EPA-821-R-02-013.

Additional guidance was provided by:

Whole Effluent Toxicity Testing Guidance and Test Review Criteria, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

DEVIATIONS FROM PROTOCOLS

Deviations from required procedures in the test methods:

None noted.

Deviations from recommended procedures in the test methods:

EPA guidance recommends the DO concentration and pH should be checked at the beginning of each test and daily throughout the test period. Due to analyst error, the pH was not measured on Day 1 of testing for the pre-measurements on the *P. promelas* chronic test.

TEST DESIGN

The following summarizes the conditions used for both overall testing and the specifics for each test (observations and notations can be found on the datasheets in Appendix A):

Overall Test Design:

Chronic tests: 1.0, 3.3, 11.0, 33.0, and 100 percent sample + dilution water for the control.

Test Organism Conditions:

All organisms tested were fed and maintained during culturing, acclimation, and testing as prescribed by the EPA (2002).

The test organisms appeared vigorous and in good condition prior to testing.

C. dubia chronic test:

Source: TA-ASL's in-house cultures

Age: Less than 24 hours old and within an 8-hour age range, with blocking by known parentage

Design: Ten test vessels per concentration, one organism per vessel
Test Solution Renewal: Daily
Monitoring:

- Daily: Survival and neonate production (with brood determination)
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination:

- Survival: @ after 7 days.
- Reproduction: When 60%+ of surviving control organisms produce a 3rd brood.

Endpoints: Survival (at Day 7) and Reproduction (through first 3 broods)

P. promelas chronic test:

Source: Aquatox Inc., Hot Springs, Arkansas
Age: Less than 48 hours old and within an 24 hour age range
Design: Four test vessels per concentration, ten organisms per vessel
Test Solution Renewal: Daily
Monitoring:

- Daily: Survival
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination: 7 days after test initiation.
Endpoints: Survival and Growth (average dry weight per organism added @ initiation)

DILUTION WATER

The dilution water used was the standard culture water used by TA-ASL:

Reconstituted, moderately hard water (as per EPA protocol) with a total hardness of 80 to 100 mg/L as $CaCO_3$ and an alkalinity of 60 to 70 mg/L as $CaCO_3$.

SAMPLE COLLECTION AND STORAGE

Samples were collected by Energy Northwest personnel. The samples were accepted as scheduled by TA-ASL. Chain of Custody and Sample Receipt Records are provided in Appendix C.

All samples were received within the EPA recommended 0 to 6 ^{o}C range.
All samples were received within the WDOE required 0 to 6 ^{o}C range.
All samples were initially used for test initiation or test solution renewal within the EPA recommended maximum holding time of 36 hours of sample collection.

All subsequent uses of a sample occurred within the EPA recommended maximum holding time of 72 hours past the time of initial use of that sample.
All subsequent uses of a sample occurred within the WDOE recommended maximum holding time of 72 hours past the time of sample collection.
Following receipt, the samples were stored in the dark at 0 to 6 C until test solutions were prepared and tested.

SAMPLE PREPARATION

Samples used during these tests were:

Temperature adjusted prior to test initiation and each daily renewal.
Dechlorination with sodium thiosulfate was performed.

DATA ANALYSIS

The statistical analyses performed for the chronic tests were those outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, USEPA Office of Water, Fourth Edition (EPA 2002), EPA-821-R-02-013, using CETIS.

Additional guidance was provided by *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

The specific statistical analysis and CETIS version used for each endpoint evaluation is listed with the statistical outputs included with each test in Appendix A.
If any additional analysis methods were also used, an explanation of the rationale and reference to the source method is included with the presentation of those results below.

RESULTS AND DISCUSSION

The raw data sheets are presented in Appendix A.

CHRONIC BIOASSAYS

Table 1 summarizes the survival and reproduction data for the *C. dubia* chronic test initiated on May 1, 2018.

Table 1
Summary of Chronic Results
C. dubia

Sample Concentration (%)	Percent Survival	Mean Number of Young Per Adult
Control	100	26.4
1.0	100	28.6
3.3	100	26.8
11.0	100	26.7
33.0	100	23.5
100	100	16.9 [a]

[a] Indicates a statistically significant difference from the control at alpha = 0.05.

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 33.0 %
LOEC = 100 %
IC_{25} = 53.6 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *C. dubia* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum 15 young produced per surviving control adult. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

Table 2 summarizes the survival and growth data for the *P. promelas* chronic test initiated on May 3, 2018.

Table 2
Summary of Chronic Results
P. promelas

Sample Concentration (%)	Percent Survival	Mean Dry Weight Per Organism Added (mg)
Control	100	0.783
1.0	100	0.706
3.3	97.5	0.695
11.0	97.5	0.787
33.0	100	0.799
100	100	0.859

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 100 %
LOEC > 100 %
IC_{25} > 100 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *P. promelas* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum weight of 0.250 mg per surviving control organism. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

REFERENCE TOXICANT TESTS

Reference toxicant (reftox) testing is performed to document both initial and ongoing laboratory performance of the test method(s). While the health of the test organisms is primarily evaluated by the performance of the laboratory control, reftox test results also may be used to assess the health and sensitivity of the test organisms. Reftox test results within their respective cumulative summary (Cusum) chart limits are indicative of consistent laboratory performance and normal test organism sensitivity.

The results of the reftox tests indicate that the test organisms were within their respective cusum chart limits based on EPA guidelines. This demonstrates ongoing laboratory proficiency of the test methods and suggests normal test organism sensitivity in the associated client testing.

The *C. dubia* chronic reftox test was conducted using sodium chloride. The *P. promelas* chronic reftox test was conducted using potassium chloride. The data sheets for the reference toxicant tests are provided in Appendix B.

Table 3 summarizes the reference toxicant test results and Cusum chart limits.

Table 3
Chronic Reference Toxicant Tests (g/L)

Species	IC_{25}	Cusum Chart Limits
C. dubia (survival)	1.41	1.10 to 2.27
C. dubia (reproduction)	0.54	0.18 to 1.21
P. promelas (survival)	0.62	0.57 to 0.64
P. promelas (growth)	0.53	0.45 to 0.73

APPENDIX A

RAW DATA SHEETS

TestAmerica

FRESHWATER TOXICITY TEST: SAMPLE AND DILUTION WATER DATA

Client: Energy Northwest — SDG # B 3990 — Test Initiation: Date 5-1-18

Contact: Jane LaPage (509) 377-4061 — Test Termination: Date 5-10-18

Sample ID Number	Field ID	Collected Date (mm/dd/yy)	Collected Time (Pacific Zone)	Received Date (mm/dd/yy)	Received Time (Pacific Zone)	Temp (°C) as Rc'vd	Total Residual Chlorine (mg/l) ☑ Dechlorination allowed as Rc'vd / after Dechlor.	Ammonia NH_3-N mg/l as Rc'vd	Hardness mg/l as $CaCO_3$ as Rc'vd	Alkalinity mg/l as $CaCO_3$ as Rc'vd	DO (mg/L) as Rc'vd	pH as Rc'vd	Cond. (uS) as Rc'vd	60 um filtered? (organisms noted)
B3990-01	181063-01	04/30/18	05:21	05/01/18	10:30	2.7	0.03 / 0.04*	<0.10	354	110	8.4	7.2	1430	☐
-02	181063-02	05/02/18	05:20	05/03/18	10:30	2.2	0.04 / 0.06*	<0.10	760	104	10.0	7.8	1392	☐
-03	181063-03	05/04/18	05:15	05/05/18	12:20	3.1	0.04 / 0.04*	<0.10	795	135	9.5	7.9	1415	☐
-04	181063-04	05/07/18	05:15	05/08/18	10:35	3.6	0.04 / 0.04*	<0.10	830	120	8.4	8.0	1436	☐
							/							
							*Did not reduce. likely interference. BAM 5-1-18							
							/							
							/							
							/							
							/							
							/							
							/							
			Reporting Limits:			na	0.02 mg/L	0.10 mg/L	5 mg/L	5 mg/L	na	na	na	na

Note: "-" Indicates data collection or dechlorination not needed. Any other adjustments to samples prior to use are documented in Comments below or on Dilutions page.

Dilution Water	ID#	Hardness mg/l as $CaCO_3$	Alkalinity mg/l as $CaCO_3$
Recon MH (FHM)	4655	80	64
	4659	96	73
	4662	82	67

Comments: ☑ Indicates the action was taken, (☐= action not taken): " - " = sample not dechlorinated, or analyte not collected/needed.

☑ Dechlorination is **REQUIRED** if Total Residual Chlorine (TRC) is detected (i.e. TRC is 0.02 mg/L or greater).

From EPA manual (EPA-821-R-02-013, 8.8.7): 0.025 ml of a 26.8 g/L stock of sodium thiosulfate will reduce 0.10 mg/L TRC in a 1L sample.

(for example: **4L** of sample at **0.10** mg/L TRC needs **0.10** ml of 26.8g/L sodium thiosulfate stock to be dechlorinated)

-01 sample Calc: (20 L sample) x (0.03 mg/L TRC) x 0.25 = ~~0.030.15~~ 0.15 ml of 26.8 g/L sodium thiosulfate to add (ID: 2B065-01) rec'd BAM 5-1-18

-02 sample Calc: (20 L sample) x (0.04 mg/L TRC) x 0.25 = 0.20 ml of 26.8 g/L sodium thiosulfate to add (ID: 2B065-01)

-03 sample Calc: (20 L sample) x (0.04 mg/L TRC) x 0.25 = 0.20 ml of 26.8 g/L sodium thiosulfate to add (ID: 2B065-01)

DO NOT add more sodium thiosulfate if "after Dechlor" TRC reading is not reduced to < 0.02 mg/L. Leave as is.

Water Quality Meters Used/ID#: Dissolved Oxygen # 4 pH # 11 Conductivity # 2

-03 Sample 21.52 L x 0.04 mg/L TRC x 0.25 = 0.22 ml of 2B065-01

TestAmerica

FRESHWATER TOXICITY TEST: TEST ORGANISM INFORMATION

Client: Energy Northwest Sample Designation (SDG): B 3990

Test Species Information	Cd # 3422 *Ceriodaphnia dubia* Chronic	FHM # 9983 *Pimephales promelas* Chronic	Cd # 3422 *Ceriodaphnia dubia* Acute		
Organism Age at Initiation	<24 hrs, all within an 8 hr window	<48 hrs, all within a 24 hour window	< 24 hrs		
Test Container Size	30 ml	800 ml	30 ml		
Test Volume	15 ml	500 ml	25 ml		
Feeding: Type and Amount	0.10 ml Algae and 0.10 ml YCT daily	0.15 ml *Artemia*, 2 x Daily	Algae and YCT during acclimation		
Aeration: In Test Chambers via Slow Bubble :	☒ None ☐ Prior to use	☑ None ☐ Prior to use ☐ @ _____ hrs	☑ None ☐ Prior to use		
Acclimation Period	<24 hrs	<24 hrs	<24 hrs		
Organism Source	In-House	Aquatox	In-House		
Size	-	-	-		
Loading Rate	-	-	-		

Dissolved Oxygen aeration justifications (in test chambers):

Test(s): ☐ All ☐ _____

Date:

Comments:

Test Solution Preparation and Dilution Record

Client: Energy Northwest

Note: ☐ Indicates task not done, ☑ Indicates task was done. Temp adj. = Temperature adjusted to ambient or test temp

Ditto marks (") indicate that the same SDG, batch of dilution water, or food as the previous day's entry was used.

Ceriodaphnia dubia - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	200
1.0	2.00	→	200
3.3	6.60	→	200
11.0	22.0	→	200
33.0	66.0	→	200
100	200	→	200

Total Sample volume needed per day = 297 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	YCT ID Used	Algae ID Used	Date	Time	Initials
0 (Initiation)	B 3990-01	☐ Temp adj, ☐ Aerated	ID # 4655	# 1161	# 1162	5/1/2018	11:40	BAM
1	B -01	☐ Temp adj, ☐ Aerated	ID # 4655	# 1161	# 1162	5/2/18	08:10	"
2	B -02	☐ Temp adj, ☐ Aerated	ID # 4655	# 1158	# 1158	5/3/18	11:30	BAM
3	B -02	☐ Temp adj, ☐ Aerated	ID # 4658	~~# 1154~~ 1160	# 1157	5/4/18	09:20	" R06-A 5-4-18
4	B -03	☐ Temp adj, ☐ Aerated	ID # 4658	# 1161	# 1162	5/5/18	13:00	BAM
5	B " -03	☐ Temp adj, ☐ Aerated	ID # 4659	# 1161	# 1162	5/6/	09:15	BM
6	B -03	☐ Temp adj, ☐ Aerated	ID # 4659	# 1160	# 1162	5/7/18	11:05	BAM
7	B	☐ Temp adj, ☐ Aerated	ID #	#	#	/ /	:	

Fathead minnow - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	2000
1.0	20.0	→	2000
3.3	66.0	→	2000
11.0	220	→	2000
33.0	660	→	2000
100	2,000	→	2000

Total Sample volume needed per day = 2966 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
~~0 (Initiation)~~	~~B 3990-01~~	~~☐ Temp adj, ☐ Aerated~~	~~ID # 4655~~	~~5/1/2018~~	~~11:45~~	~~BAM~~ R06BAM 5-3-18
0	B 3990-02	☐ Temp adj, ☐ Aerated	ID # 4657	5/3/18	11:39	BAM
1	B -02	☐ Temp adj, ☐ Aerated	ID # 4658	5/4/18	09:20	"
2	B -03	☐ Temp adj, ☐ Aerated	ID # 4658	5/5/18	13:05	BAM
3	B -03	☐ Temp adj, ☐ Aerated	ID # 4658	5/6/	09:15	BM
4	B -03	☐ Temp adj, ☐ Aerated	ID # 4659	5/7/18	11:10	BAM
5	B -03 ~~04~~	☐ Temp adj, ☐ Aerated R06BAM 5-8-18	ID # 4659	5/8/18	:	BAM
6	04		4662	5/9/18	09:20	"

Fish did not show up

Ceriodaphnia dubia - Acute

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	200
6.25	12.5	→	200
11.0	22.0	→	200
25.0	50.0	→	200
50.0	100	→	200
100	200	→	200

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
0 (Initiation)	B 3990-01	☐ Temp adj, ☐ Aerated	ID # 4655	5/1/2018	11:55	BAM

Total Sample volume needed per day = 385 mls

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: Energy Northwest Test Start Date: 5-1-18

Sample Description: Initial Sample ID#: B 3990-01

Data summarized by: BM

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	14	28	29	31	29	27	33	25	35	13	10	264
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.0 %	30	29	30	30	23	31	35	31	33	14	10	286
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
3.3 %	26	32	31	36	24	28	31	31	19	10	10	268
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
11.0 %	14	31	30	32	26	28	32	29	33	12	10	267
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
33.0 %	16	25	27	20	29	28	29	33	15	13	10	235
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
100 %	16	24	21	16	15	22	23	10	~~24~~ 18	4	10	169
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		

Survival data summarized through Day 7. 60%+ of surviving controls with 3+ broods first observed on Day 6.

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination (for WDOE only, = Number of test organisms alive at Day 7)

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CERIODAPHNIA CHRONIC SURVIVAL AND REPRODUCTION DATA

Neo's obtained from	A	B	C	D	E	F	G	H	I	J
Culture Board ID:	J	J	J	J	J	J	J	J	J	J
Slot #:	12	17	18	23	32	34	36	37	43	48

Incubator Used: # 6
Random Template Used: 6 conc # 7

Client: Energy Northwest
Test Initiation: Date: 5/1/2018 Time: 14:35
Sample Description:
Initial Sample ID # B 3990 - 01
Termination: Date: 5/8/2018 Time: 09:20

Technician: Day 0 Bw, Day 1 [illegible], Day 2 Bw, Day 3 [illegible], Day 4 Bw, Day 5 Bw, Day 6 Bw, Day 7 Bw, Day 8
Time: Day 0 1435, Day 1 0956, Day 2 1225, Day 3 1325, Day 4 1430, Day 5 1055, Day 6 1155, Day 7 0920, Day 8

Percent	Day	Daily Number of Live Young for each Replicate A	B	C	D	E	F	G	H	I	J	No. Live Adults	Daily Total Live Young
Control	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	3	0	5	0	0	0	0	0	0	10	8
	4	5	0	6	0	6	4	6	5	7	3	10	42
	5	9	11	10	11	10	9	11	9	13	10	10	103
	6	0	14	13	15	13	14	16	11	15	0	10	121
	7	13	–	–	✓	–	–	–	–	–	15	10	–
	8												
1.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	0	3	0	5	6	0	5	0	10	19
	4	6	4	6	0	6	0	0	6	0	5	10	33
	5	12	11	10	11	8	11	11	12	13	9	10	108
	6	12	14	14	16	9	15	12	13	15	0	10	126
	7	–	–	–	–	–	✓	✓	–	–	17	10	–
	8												
3.3 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	3	4	0	0	3	0	5	2	0	0	10	17
	4	0	0	7	5	0	4	0	0	6	3	10	25
	5	9	12	10	13	9	10	11	11	13	7	10	105
	6	14	16	14	12	13	14	15	18	0	0	10	121
	7	–	–	–	–	✓	–	–	–	15	15	10	–
	8												
11.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	5	3	0	2	4	0	3	0	0	10	17
	4	4	0	0	6	0	0	5	10	6	4	10	26
	5	10	11	10	10	10	10	11	11	11	8	10	102
	6	0	15	17	16	14	14	16	14	16	0	10	122
	7	12	–	–	–	–	✓	–	✓	–	15	10	–
	8												
33.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	2	4	0	0	0	2	5	0	0	10	13
	4	6	0	0	4	4	3	0	0	5	4	10	26
	5	10	12	9	10	10	12	11	10	10	9	10	103
	6	0	11	14	6	15	13	16	18	0	0	10	93
	7	10	✓	✓	–	–	–	✓	–	16	15	10	–
	8												
100 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	0	0	0	0	0	0	0	0	10	0
	4	7	1	1	0	0	2	0	0	1	0	10	12
	5	9	9	7	4	7	7	8	10	5	4	10	72
	6	0	14	13	10	8	13	15	0	12	0	10	85
	7	14	–	–	12	–	–	–	7	–	–	10	–
	8												

"AD" = Adult Dead, "AY" = Aborted young, "M" = male organism, "F" = Female, "R" = Adult releasing young, " / " = split brood (carry-over brood / current day brood),
"Inj" = Adult Injured during test solution renewal, replicate removed from analysis. "AM" = Adult missing, remove from analysis. A circled neonate count = 4th brood

Footnote: As per WDOE, C. dubia test reproduction should be when 60% of the surviving control organisms have produced their third brood (Days 6, 7, or 8). Survival is at seven days.

✓ = neonates present, not accurately counted on Day 7 - not needed Bw 5-9-18

TestAmerica

CERIODAPHNIA WATER QUALITY DATA

Client: Energy Northwest | Initiated Date: 5/1/2018 Time: 14:35 | Adults Isolated Date: 4/30/2018 Time: 17:00

Sample Description: | Initial Sample ID #: B3490 - 01 | Neo's Collected Date: 4/30/2018 Time: 23:45

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Tech:	BM	[illegible]	BM	[illegible]	BM	BM	BM	BM	
Time	14:40	11:15	14:25	14:25	14:38	12:10	16:30	09:50	:
Therm.	# 251	# 251	# 251	# 250	# 250	# 250	# 250	# 251	#

Dissolved Oxygen (mg/l)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.6	7.8 / 8.0	8.3 / 8.2	7.9 / 8.0	8.0 / 8.2	8.0 / 7.9	8.3 / 8.3	8.2	
1.0 %	7.7	7.8 / 8.0	8.4 / 8.2	7.9 / 8.0	7.8 / 8.0	7.9 / 7.9	8.3 / 8.3	8.1	
3.3 %	7.7	7.8 / 7.7	8.6 / 8.3	7.8 / 7.8	7.9 / 8.1	7.8 / 8.0	8.3 / 8.3	8.2	
11.0 %	7.7	7.7 / 8.0	8.7 / 8.3	7.7 / 8.0	8.1 / 8.1	7.9 / 8.1	8.4 / 8.3	8.1	
33.0 %	7.7	7.7 / 8.1	8.7 / 8.3	7.8 / 8.0	8.3 / 8.1	7.9 / 8.1	8.3 / 8.3	8.0	
100 %	7.9	7.7 / 7.5	8.4 / 8.4	7.9 / 7.9	8.2 / 8.1	8.0 / 8.2	8.3 / 8.2	8.2	

pH

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.9	7.7 / 7.7	8.0 / 7.9	7.9 / 7.8	8.0 / 8.1	7.7 / 8.0	8.4 / 8.2	7.8	
1.0 %	7.9	7.7 / 7.8	8.0 / 8.0	7.9 / 7.8	8.0 / 8.1	7.7 / 7.9	8.3 / 8.2	7.8	
3.3 %	7.8	7.7 / 7.8	8.0 / 8.0	7.9 / 7.8	8.0 / 8.1	7.7 / 7.9	8.2 / 8.2	7.8	
11.0 %	7.8	7.7 / 7.7	7.9 / 7.9	7.9 / 7.8	8.0 / 8.0	7.7 / 7.8	8.2 / 8.2	7.8	
33.0 %	7.8	7.7 / 7.6	7.9 / 7.9	7.8 / 7.8	8.0 / 8.0	7.7 / 7.8	8.1 / 8.1	7.7	
100 %	7.7	7.6 / 7.6	7.9 / 7.9	7.8 / 8.0	8.0 / 8.0	7.8 / 7.8	8.0 / 8.0	7.7	

Temperature (°C) / Conductivity (µS) (1st use of each sample only)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	25.3 / 311	25.6	24.6 / 344	24.6	24.8 / 312	25.0	24.9	24.6	
1.0 %	25.1 / 324	24.3	24.7 / 357	24.3	25.0 / 329	25.0	25.2	25.8	
3.3 %	25.2 / 360	24.4	25.6 / 395	24.6	25.8 / 360	25.8	25.4	25.5	
11.0 %	25.1 / 465	25.0	24.5 / 477	25.0	24.9 / 482	25.8	24.9	25.2	
33.0 %	25.1 / 738	25.6	25.5 / 726	25.1	25.0 / 706	25.5	25.9	25.2	
100 %	25.3 / 1467	25.3	24.3 / 1399	24.6	24.6 / 1380	24.9	26.0	24.5	

COMMENTS: Temperatures taken just prior to test solution renewals. DO, pH, and Conductivity taken following organism transfer.

23.8 = Temp out of recom. range

Note: All Day 0 data represents conditions at initiation. All other days: numerator represents pre-renewal conditions, denominator represents post-renewal conditions.

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Batch ID:	14-0029-3205	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	01 May-18 14:35	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	08 May-18 09:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 19h	**Source:**	In-House Culture	**Age:**	<24H

Sample ID:	08-6195-8425	**Code:**	B3990-01 ✓	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151) ✓		
Sample Age:	33h (2.7 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
06-6062-3441	7d Survival Rate	100	>100	NA	NA	1	Fisher Exact/Bonferroni-Holm Test
01-6798-9167	Reproduction	33	100	57.45	27.1%	3.03	Steel Many-One Rank Sum Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
13-2991-5185	Reproduction	IC25	53.63	20.19	81.06	1.865	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
06-6062-3441	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria ✓
01-6798-9167	Reproduction	Control Resp	26.4	15 - NL	Yes	Passes Acceptability Criteria ✓
13-2991-5185	Reproduction	Control Resp	26.4	15 - NL	Yes	Passes Acceptability Criteria ✓
01-6798-9167	Reproduction	PMSD	0.2705	0.13 - 0.47	Yes	Passes Acceptability Criteria ✓

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	1	1	1	1	1	0	0	0.0%	0.0%
1		10	1	1	1	1	1	0	0	0.0%	0.0%
3.3		10	1	1	1	1	1	0	0	0.0%	0.0%
11		10	1	1	1	1	1	0	0	0.0%	0.0%
33		10	1	1	1	1	1	0	0	0.0%	0.0%
100		10	1	1	1	1	1	0	0	0.0%	0.0%

Reproduction Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	26.4	21.12	31.68	13	35	2.334	7.382	27.96%	0.0%
1		10	28.6	24.32	32.88	14	35	1.893	5.985	20.93%	-8.33%
3.3		10	26.8	21.38	32.22	10	36	2.398	7.584	28.3%	-1.52%
11		10	26.7	21.31	32.09	12	33	2.381	7.528	28.2%	-1.14%
33		10	23.5	18.52	28.48	13	33	2.202	6.964	29.63%	10.98%
100		10	16.9	12.43	21.37	4	24	1.975	6.244	36.95%	35.98%

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	14	28	29	31	29	27	33	25	35	13
1		30	29	30	30	23	31	35	31	33	14
3.3		26	32	31	36	24	28	31	31	19	10
11		14	31	30	32	26	28	32	29	33	12
33		16	25	27	20	29	28	29	33	15	13
100		16	24	21	16	15	22	23	10	18	4

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
11		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
33		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	06-6062-3441	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 11:54	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	14-0029-3205	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	01 May-18 14:35	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	08 May-18 09:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 19h	**Source:**	In-House Culture	**Age:**	<24H
Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	33h (2.7 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	NOEL	LOEL	TOEL	TU
Untransformed		C > T	NA	NA	100	>100	NA	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	C-%	Test Stat	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	1	1.0000	Exact	Non-Significant Effect
		3.3	1	1.0000	Exact	Non-Significant Effect
		11	1	1.0000	Exact	Non-Significant Effect
		33	1	1.0000	Exact	Non-Significant Effect
		100	1	1.0000	Exact	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Dilution Water	10	0	10	1	0	0.0%
1		10	0	10	1	0	0.0%
3.3		10	0	10	1	0	0.0%
11		10	0	10	1	0	0.0%
33		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

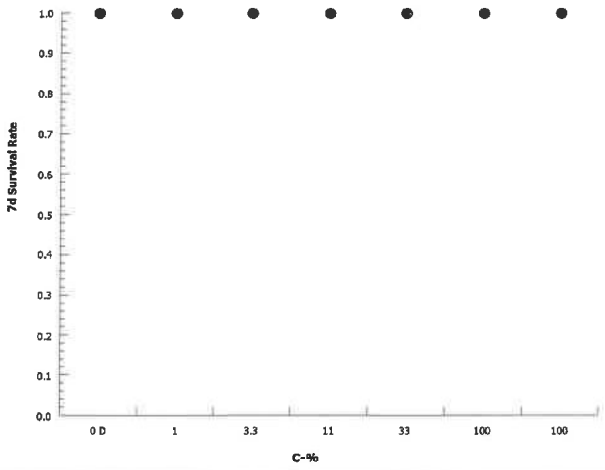
7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
11		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
33		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	06-6062-3441	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 11:54	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	01-6798-9167	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 11:54	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-0029-3205	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	01 May-18 14:35	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	08 May-18 09:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 19h	**Source:**	In-House Culture	**Age:**	<24H
Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	33h (2.7 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C > T	NA	NA	27.1%	33	100	57.45	3.03

Steel Many-One Rank Sum Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	118.5	75	5	18	0.9860	Asymp	Non-Significant Effect
		3.3	107	75	2	18	0.8746	Asymp	Non-Significant Effect
		11	109	75	5	18	0.9082	Asymp	Non-Significant Effect
		33	92.5	75	6	18	0.4393	Asymp	Non-Significant Effect
		100*	71	75	0	18	0.0214	Asymp	Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	26.4	15 - NL	Yes	Passes Acceptability Criteria
PMSD	0.2705	0.13 - 0.47	Yes	Passes Acceptability Criteria

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value	2.517	3.2	0.5945	No Outliers Detected
Control Trend	Mann-Kendall Trend	2.517	1.96	0.8575	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	887.0833	177.4167	5	3.646	0.0065	Significant Effect
Error	2627.9	48.66481	54			
Total	3514.983		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	0.8538	15.09	0.9735	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8844	0.9459	<0.0001	Non-normal Distribution

Reproduction Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	10	26.4	21.12	31.68	28.5	13	35	2.334	27.96%	0.0%
1		10	28.6	24.32	32.88	30	14	35	1.893	20.93%	-8.33%
3.3		10	26.8	21.38	32.22	29.5	10	36	2.398	28.3%	-1.52%
11		10	26.7	21.31	32.09	29.5	12	33	2.381	28.2%	-1.14%
33		10	23.5	18.52	28.48	26	13	33	2.202	29.63%	10.98%
100		10	16.9	12.43	21.37	17	4	24	1.975	36.95%	35.98%

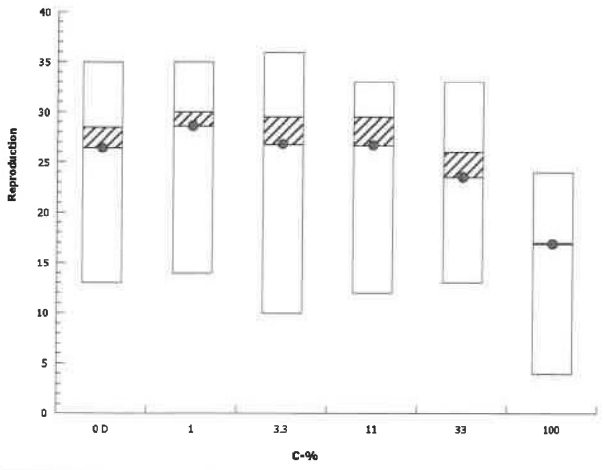
Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

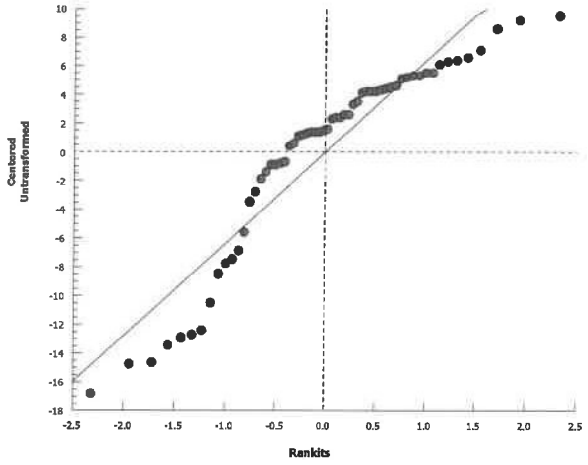
Analysis ID:	01-6798-9167	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 11:54	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	14	28	29	31	29	27	33	25	35	13
1		30	29	30	30	23	31	35	31	33	14
3.3		26	32	31	36	24	28	31	31	19	10
11		14	31	30	32	26	28	32	29	33	12
33		16	25	27	20	29	28	29	33	15	13
100		16	24	21	16	15	22	23	10	18	4

Graphics





CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	13-2991-5185	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 11:54	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Batch ID:	14-0029-3205	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	01 May-18 14:35	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	08 May-18 09:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 19h	**Source:**	In-House Culture	**Age:**	<24H

Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	33h (2.7 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1177555	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	26.4	15 - NL	Yes	Passes Acceptability Criteria

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Extreme Value	Grubbs Extreme Value	2.517	3.2	0.5945	No Outliers Detected
Control Trend	Mann-Kendall Trend	2.517	1.96	0.8575	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	53.63	20.19	81.06	1.865	1.234	4.953

Reproduction Summary

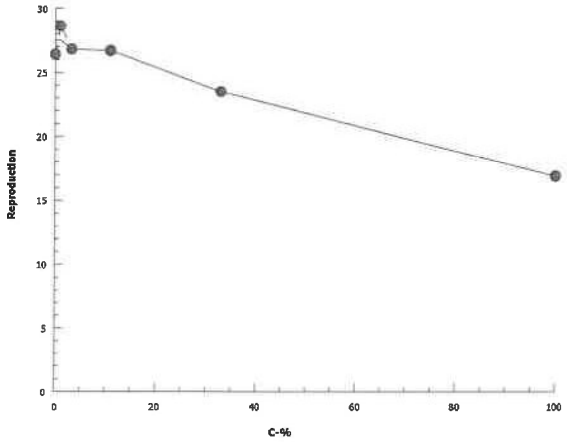
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	26.4	13	35	2.334	7.382	27.96%	0.0%
1		10	28.6	14	35	1.893	5.985	20.93%	-8.33%
3.3		10	26.8	10	36	2.398	7.584	28.3%	-1.52%
11		10	26.7	12	33	2.381	7.528	28.2%	-1.14%
33		10	23.5	13	33	2.202	6.964	29.63%	10.98%
100		10	16.9	4	24	1.975	6.244	36.95%	35.98%

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	14	28	29	31	29	27	33	25	35	13
1		30	29	30	30	23	31	35	31	33	14
3.3		26	32	31	36	24	28	31	31	19	10
11		14	31	30	32	26	28	32	29	33	12
33		16	25	27	20	29	28	29	33	15	13
100		16	24	21	16	15	22	23	10	18	4

Ceriodaphnia 7-d Survival and Reproduction Test					**TestAmerica - ASL**
Analysis ID:	13-2991-5185	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 11:54	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 9 | Waterbath/incubator Used: # 4 | Date Initiated 5/3/2018 Time 15:15

Initial sample ID B 3990 -02 | Date Terminated 5/10/2018 Time 09:50

Client: Energy Northwest | Sample Description:

Tech: Day 0 BM/BAM Day 1 BAM Day 2 BAM Day 3 BAM Day 4 BAM Day 5 O/BAM Day 6 O/BM Day 7 BAM

Time: Day 0 1515 Day 1 1400 Day 2 1400 Day 3 1550 Day 4 1450 Day 5 1600 Day 6 1420 Day 7 0950

Conc. or Percent	Day	Number of Live Organisms				Dissolved O_2 (mg/l)		pH		Temp. (°C)	Therm. ID #	Conductivity (µS)
		A	B	C	D	Pre	Post	Pre	Post	Pre		Post (1st use)
Control	0	10	10	10	10		8.1		8.0	Post: 24.4	250	334
	1	10	10	10	10	6.5	7.8	*	8.2	24.4	251	
	2	10	10	10	10	6.3	8.1	7.6	8.1	24.5	251	304
	3	10	10	10	10	6.7	8.2	7.8	8.0	24.3	252	
	4	10	10	10	10	6.8	8.1	7.3	8.0	24.4	252	
	5	10	10	10	10	7.1	7.5	7.5	8.0	24.2	257	362
	6	10	10	10	10	6.3	7.8	7.5	8.0	24.0	251	
	7	10	10	10	10	6.4		7.3		25.5	250	
1.0 %	0	10	10	10	10		8.2		8.0	Post: 24.4		359
	1	10	10	10	10	6.5	7.9	*	8.2	24.4		
	2	10	10	10	10	6.3	8.2	7.6	8.1	24.5		317
	3	10	10	10	10	6.5	8.2	7.8	8.1	24.3		
	4	10	10	10	10	7.1	8.2	7.4	8.1	24.5		
	5	10	10	10	10	7.3	8.0	7.5	8.0	24.2		376
	6	10	10	10	10	6.4	7.9	7.5	8.0	24.1		
	7	10	10	10	10	6.4		7.3		25.3		
3.3 %	0	10	10	10	10		8.3		8.0	Post: 24.4		382
	1	10	10	10	10	6.6	7.9	*	8.1	24.3		
	2	9	10	10	10	6.2	8.1	7.5	8.1	24.5		356
	3	9	10	10	10	6.5	8.2	7.7	8.1	24.3		
	4	9	10	10	10	7.1	8.3	7.4	8.1	24.3		
	5	9	10	10	10	7.2	8.1	7.5	8.1	24.2		386
	6	9	10	10	10	6.2	7.9	7.5	8.0	24.0		
	7	9	10	10	10	6.4		7.3		25.4		
11.0 %	0	10	10	10	10		8.2		8.0	Post: 24.4		484
	1	10	10	10	10	6.5	7.9	*	8.0	24.3		
	2	10	10	10	10	6.1	8.2	7.5	8.0	24.6		463
	3	10	10	10	10	6.5	8.3	7.6	8.1	24.4		
	4	10	10	9	10	7.2	8.3	7.5	8.0	24.5		
	5	10	10	9	10	7.0	8.2	7.5	8.1	24.2		501
	6	10	10	9	10	6.1	7.9	7.4	8.0	24.1		
	7	10	10	9	10	6.2		7.3		25.5		
33.0 %	0	10	10	10	10		8.3		7.9	Post: 24.4		741
	1	10	10	10	10	6.6	8.1	*	7.9	24.4		
	2	10	10	10	10	6.1	8.2	7.5	8.0	24.6		733
	3	10	10	10	10	6.6	8.2	7.6	8.0	24.5		
	4	10	10	10	10	7.1	8.3	7.5	8.0	24.5		
	5	10	10	10	10	7.0	8.3	7.4	8.0	24.2		753
	6	10	10	10	10	6.0	8.1	7.4	7.9	24.0		
	7	10	10	10	10	6.2		7.3		25.6		
100 %	0	10	10	10	10		8.3		7.8	Post: 24.4		1393
	1	10	10	10	10	6.7	8.2	*	7.8	24.3		
	2	10	10	10	10	6.4	8.3	7.5	7.9	24.4		1415
	3	10	10	10	10	6.5	8.3	7.6	7.9	24.3		
	4	10	10	10	10	7.2	8.3	7.5	7.9	24.3		
	5	10	10	10	10	7.0	8.3	7.4	7.8	24.2		1425
	6	10	10	10	10	6.1	8.0	7.4	7.8	24.0		
	7	10	10	10	10	6.1		7.2		25.3		

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.
☐ Aeration in test chambers begun @ _____ (Note observations on Test Organism Info sheet)

Pre =Pre-renewal solutions. Post =Post-renewal solutions.
Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
(23.8) = Temp. out of recommended range

* Measurement missed by analyst. BAM 5-4-18

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy NW | Tins Labeled As: E. NW

Lab ID: B3990 | Start Date: 5/3/2018

Sample Description:

Technician:		PC
Date:		5/9/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A		1110.07	10
	B		1105.44	10
	C		1098.64	10
	D		1091.77	10
1 %	A		1067.12	10
	B		1082.97	10
	C		1089.00	10
	D		1089.99	10
3.3 %	A		1087.96	9
	B		1116.27	10
	C		1088.51	10
	D		1077.23	10
11 %	A		1108.93	10
	B		1091.80	10
	C		1095.87	9
	D		1103.82	10
33 %	A		1107.51	10
	B		1090.42	10
	C		1102.79	10
	D		1114.10	10
100 %	A		1079.37	10
	B		1108.95	10
	C		1078.77	10
	D		1107.06	10
	A			
	B			
	C			
	D			

weigh to 0.01 mg

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy NW | Tins Labeled As: E. NW

Lab ID: B3990 | Start Date: 5/3/2018

Sample Description:

Technician:	MB	PC
Date:	5/21/2018	5/9/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A	1118.03	1110.07	10
	B	1113.22	1105.44	10
	C	1105.75	1098.64	10
	D	1100.23	1091.77	10
1 %	A	1074.62	1067.12	10
	B	1089.73	1082.97	10
	C	1095.99	1089.00	10
	D	1096.96	1089.99	10
3.3 %	A	1094.44	1087.96	9
	B	1123.75	1116.27	10
	C	1094.99	1088.51	10
	D	1084.59	1077.23	10
11 %	A	1116.74	1108.93	10
	B	1099.91	1091.80	10
	C	1103.66	1095.87	9
	D	1111.59	1103.82	10
33 %	A	1115.52	1107.51	10
	B	1098.16	1090.42	10
	C	1110.85	1102.79	10
	D	1122.23	1114.10	10
100 %	A	1087.79	1079.37	10
	B	1118.06	1108.95	10
	C	1087.77	1078.77	10
	D	1114.87	1107.06	10
	A			
	B			
	C			
	D			

weigh to 0.01 mg

CETIS Summary Report

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Batch ID:	14-2778-4926	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	03 May-18 15:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	10 May-18 09:50	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 19h	**Source:**	Aquatox, AR	**Age:**	1 D

Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	82h (2.7 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
15-6990-4151	7d Survival Rate	100	>100	NA	5.6%	1	Steel Many-One Rank Sum Test
00-2707-9796	Mean Dry Biomass-mg	100	>100	NA	9.4%	1	Dunnett Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
01-4016-7937	Mean Dry Biomass-mg	IC25	>100	N/A	N/A	<1	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
15-6990-4151	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
00-2707-9796	Mean Dry Biomass-mg	Control Resp	0.7828	0.25 - NL	Yes	Passes Acceptability Criteria
01-4016-7937	Mean Dry Biomass-mg	Control Resp	0.7828	0.25 - NL	Yes	Passes Acceptability Criteria
00-2707-9796	Mean Dry Biomass-mg	PMSD	0.09399	0.12 - 0.3	Yes	Below Acceptability Criteria

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
1		4	1	1	1	1	1	0	0	0.0%	0.0%
3.3		4	0.975	0.8954	1	0.9	1	0.025	0.05	5.13%	2.5%
11		4	0.975	0.8954	1	0.9	1	0.025	0.05	5.13%	2.5%
33		4	1	1	1	1	1	0	0	0.0%	0.0%
100		4	1	1	1	1	1	0	0	0.0%	0.0%

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.7828	0.6939	0.8716	0.711	0.846	0.02791	0.05582	7.13%	0.0%
1		4	0.7055	0.6555	0.7555	0.676	0.75	0.01572	0.03144	4.46%	9.87%
3.3		4	0.695	0.6083	0.7817	0.648	0.748	0.02725	0.05449	7.84%	11.21%
11		4	0.787	0.7614	0.8126	0.777	0.811	0.008041	0.01608	2.04%	-0.54%
33		4	0.7985	0.7714	0.8256	0.774	0.813	0.008529	0.01706	2.14%	-2.01%
100		4	0.8585	0.7632	0.9538	0.781	0.911	0.02994	0.05989	6.98%	-9.68%

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
1		1	1	1	1
3.3		0.9	1	1	1
11		1	1	0.9	1
33		1	1	1	1
100		1	1	1	1

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.796	0.778	0.711	0.846
1		0.75	0.676	0.699	0.697
3.3		0.648	0.748	0.648	0.736
11		0.781	0.811	0.779	0.777
33		0.801	0.774	0.806	0.813
100		0.842	0.911	0.9	0.781

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	10/10
1		10/10	10/10	10/10	10/10
3.3		9/10	10/10	10/10	10/10
11		10/10	10/10	9/10	10/10
33		10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	10/10

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	15-6990-4151	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 12:06	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Batch ID:	14-2778-4926	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	03 May-18 15:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	10 May-18 09:50	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 19h	**Source:**	Aquatox, AR	**Age:**	1 D

Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	82h (2.7 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Angular (Corrected)	NA	C > T	NA	NA	5.6%	100	>100	NA	1

Steel Many-One Rank Sum Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	18	10	1	6	0.8333	Asymp	Non-Significant Effect
		3.3	16	10	1	6	0.6105	Asymp	Non-Significant Effect
		11	16	10	1	6	0.6105	Asymp	Non-Significant Effect
		33	18	10	1	6	0.8333	Asymp	Non-Significant Effect
		100	18	10	1	6	0.8333	Asymp	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			1.0000	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.00885311	0.001770622	5	0.8	0.5640	Non-Significant Effect
Error	0.039839	0.002213278	18			
Total	0.04869211		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	0.8	4.248	0.5640	Equal Variances
Variances	Levene Equality of Variance	7.2	4.248	0.0007	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.6154	0.884	<0.0001	Non-normal Distribution

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	1	0	0.0%	0.0%
1		4	1	1	1	1	1	1	0	0.0%	0.0%
3.3		4	0.975	0.8954	1	1	0.9	1	0.025	5.13%	2.5%
11		4	0.975	0.8954	1	1	0.9	1	0.025	5.13%	2.5%
33		4	1	1	1	1	1	1	0	0.0%	0.0%
100		4	1	1	1	1	1	1	0	0.0%	0.0%

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID: 15-6990-4151 **Endpoint:** 7d Survival Rate **CETIS Version:** CETISv1.8.8
Analyzed: 22 May-18 12:06 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

Angular (Corrected) Transformed Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	0.0%
1		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	0.0%
3.3		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%
11		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%
33		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	0.0%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	0.0%

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
1		1	1	1	1
3.3		0.9	1	1	1
11		1	1	0.9	1
33		1	1	1	1
100		1	1	1	1

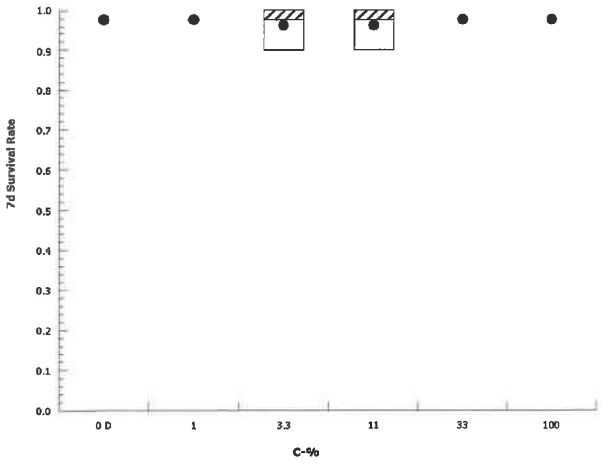
Angular (Corrected) Transformed Detail

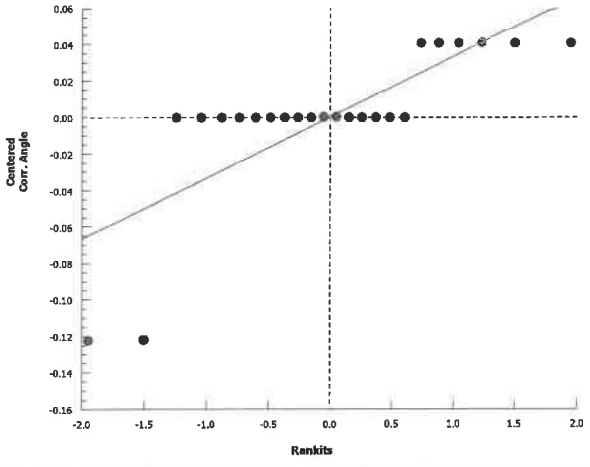
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.412	1.412	1.412	1.412
1		1.412	1.412	1.412	1.412
3.3		1.249	1.412	1.412	1.412
11		1.412	1.412	1.249	1.412
33		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	10/10
1		10/10	10/10	10/10	10/10
3.3		9/10	10/10	10/10	10/10
11		10/10	10/10	9/10	10/10
33		10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	10/10

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	00-2707-9796	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 12:09	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	14-2778-4926	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	03 May-18 15:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	10 May-18 09:50	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 19h	**Source:**	Aquatox, AR	**Age:**	1 D
Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	82h (2.7 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C > T	NA	NA	9.4%	100	>100	NA	1

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1*	2.528	2.407	0.074	6	0.0397	CDF	Significant Effect
		3.3*	2.871	2.407	0.074	6	0.0200	CDF	Significant Effect
		11	-0.139	2.407	0.074	6	0.8710	CDF	Non-Significant Effect
		33	-0.5152	2.407	0.074	6	0.9417	CDF	Non-Significant Effect
		100	-2.479	2.407	0.074	6	0.9998	CDF	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.7828	0.25 - NL	Yes	Passes Acceptability Criteria
PMSD	0.09399	0.12 - 0.3	Yes	Below Acceptability Criteria

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			1.0000	Non-significant Trend in Controls

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.07549301	0.0150986	5	8.082	0.0004	Significant Effect
Error	0.03362755	0.001868197	18			
Total	0.1091206		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	7.56	15.09	0.1822	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9638	0.884	0.5200	Normal Distribution

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	0.7828	0.6939	0.8716	0.787	0.711	0.846	0.02791	7.13%	0.0%
1		4	0.7055	0.6555	0.7555	0.698	0.676	0.75	0.01572	4.46%	9.87%
3.3		4	0.695	0.6083	0.7817	0.692	0.648	0.748	0.02725	7.84%	11.21%
11		4	0.787	0.7614	0.8126	0.78	0.777	0.811	0.008041	2.04%	-0.54%
33		4	0.7985	0.7714	0.8256	0.8035	0.774	0.813	0.008529	2.14%	-2.01%
100		4	0.8585	0.7632	0.9538	0.871	0.781	0.911	0.02994	6.98%	-9.68%

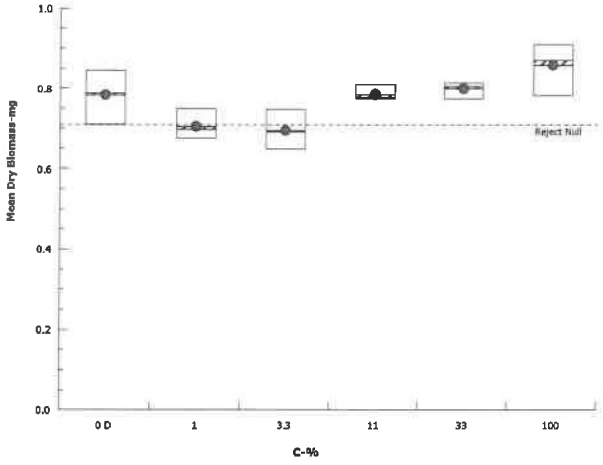
Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

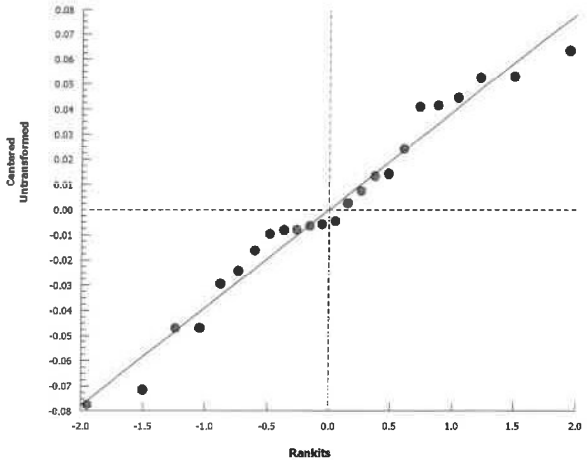
Analysis ID:	00-2707-9796	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 12:09	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.796	0.778	0.711	0.846
1		0.75	0.676	0.699	0.697
3.3		0.648	0.748	0.648	0.736
11		0.781	0.811	0.779	0.777
33		0.801	0.774	0.806	0.813
100		0.842	0.911	0.9	0.781

Graphics





CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	01-4016-7937	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 12:07	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Batch ID:	14-2778-4926	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	03 May-18 15:15	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	10 May-18 09:50	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 19h	**Source:**	Aquatox, AR	**Age:**	1 D

Sample ID:	08-6195-8425	**Code:**	B3990-01	**Client:**	
Sample Date:	30 Apr-18 05:27	**Material:**	Unknown	**Project:**	
Receive Date:	01 May-18 10:30	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	82h (2.7 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	121324	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.7828	0.25 - NL	Yes	Passes Acceptability Criteria

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Control Trend	Mann-Kendall Trend			1.0000	Non-significant Trend in Controls

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	N/A	N/A	<1	NA	NA

Mean Dry Biomass-mg Summary

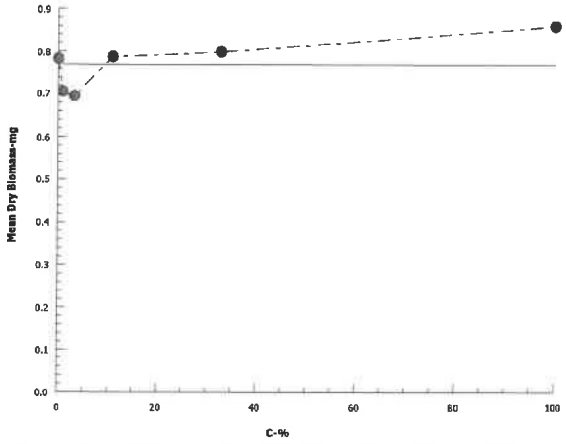
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.7828	0.711	0.846	0.02791	0.05582	7.13%	0.0%
1		4	0.7055	0.676	0.75	0.01572	0.03144	4.46%	9.87%
3.3		4	0.695	0.648	0.748	0.02725	0.05449	7.84%	11.21%
11		4	0.787	0.777	0.811	0.008041	0.01608	2.04%	-0.54%
33		4	0.7985	0.774	0.813	0.008529	0.01706	2.14%	-2.01%
100		4	0.8585	0.781	0.911	0.02994	0.05989	6.98%	-9.68%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.796	0.778	0.711	0.846
1		0.75	0.676	0.699	0.697
3.3		0.648	0.748	0.648	0.736
11		0.781	0.811	0.779	0.777
33		0.801	0.774	0.806	0.813
100		0.842	0.911	0.9	0.781

Fathead Minnow 7-d Larval Survival and Growth Test					TestAmerica - ASL
Analysis ID:	01-4016-7937	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	22 May-18 12:07	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



APPENDIX B

REFERENCE TOXICANT DATA SHEETS

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: QA / QC Test Start Date: 5-1-18

Sample Description: NaCl Initial Sample ID#: 2B068-06

Data summarized by: BW

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	30	34	32	34	26	31	28	31	33	30	10	309
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
0.25 g/L	32	15	28	28	25	31	26	31	34	30	10	280
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
0.50 g/L	32	19	27	14	22	29	25	22	28	22	10	240
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.0 g/L	25	14	10	20	8	15	17	23	18	8	10	158
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.5 g/L	1	12	7	0	5	14	3	1	9	18	7	70
	AD?	AD?	AD?	AD? ✓	AD?	AD?	AD? ✓	AD? ✓	AD?	AD?		
2.0 g/L	0	0	0	0	0	0	0	0	0	0	0	0
	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓		
4.0 g/L	0	0	0	0	0	0	0	0	0	0	0	0
	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓	AD? ✓		

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

Endpoint	IC25	Cusum Chart Limits
Survival	1.41	1.10 to 2.27
Reproduction	0.54	0.18 to 1.21

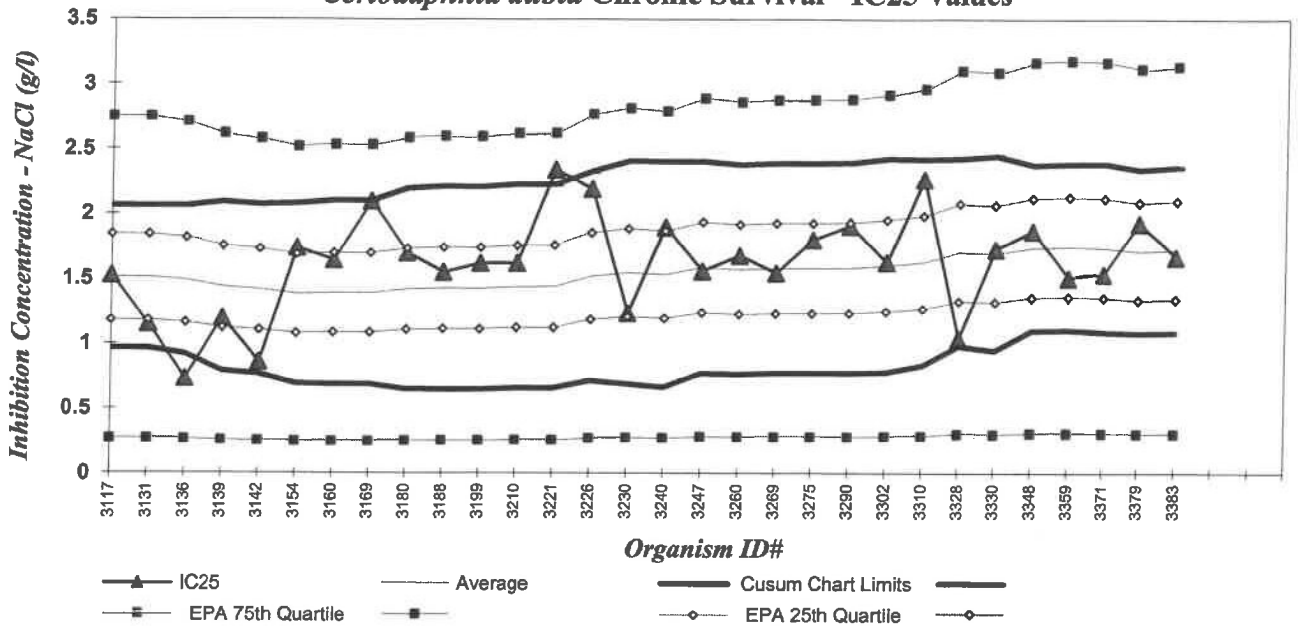
Task Manager

Project Manager

QA Officer 5-10-18

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART

Ceriodaphnia dubia Chronic Survival - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.07

25th Quartile CV (*warning limit*) = 0.11

75th Quartile CV (warning *limit*) = 0.41

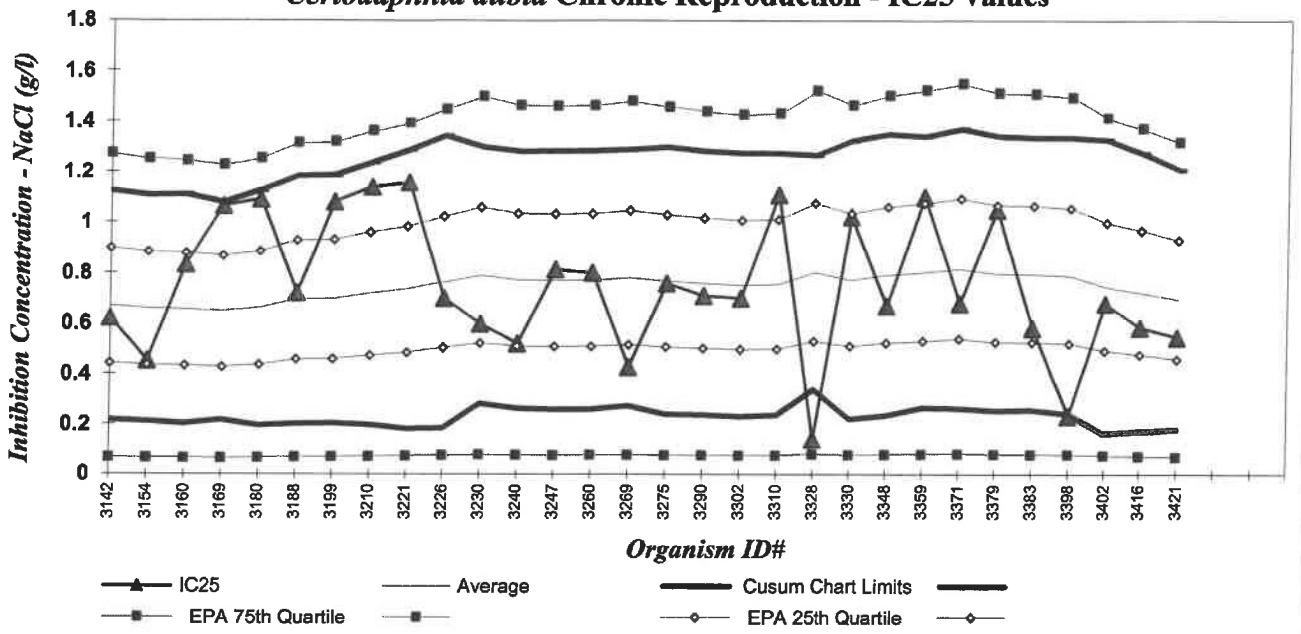
90th Quartile CV (*control limit*) = 0.81

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's),*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
316	3328	07/20/17	1.04	1.70	0.36	**0.98**	**2.43**	0.22
317	3330	08/01/17	1.73	1.70	0.37	**0.95**	**2.45**	0.18
318	3348	09/07/17	1.87	1.74	0.32	**1.10**	**2.38**	0.18
319	3359	10/03/17	1.51	1.75	0.32	**1.11**	**2.39**	0.19
320	3371	11/07/17	1.54	1.74	0.32	**1.09**	**2.39**	0.18
321	3379	12/12/17	1.93	1.71	0.32	**1.08**	**2.34**	0.19
322	3383	01/09/18	1.67	1.72	0.32	**1.08**	**2.36**	0.18
323	3398	02/06/18	1.36	1.73	0.32	**1.10**	**2.36**	0.19
324	3402	02/27/18	1.68	1.72	0.33	**1.06**	**2.37**	0.19
325	3416	04/10/18	1.62	1.72	0.33	**1.07**	**2.37**	0.17
326	3421	05/01/18	1.41	1.68	0.29	**1.10**	**2.27**	0.17
327								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART
Ceriodaphnia dubia Chronic Reproduction - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Reproduction

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.08

25th Quartile CV (*warning limit*) = 0.17

75th Quartile CV (warning *limit*) = 0.45

90th Quartile CV (*control limit*) = 0.62

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's),*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
318	3348	9/7/2017	0.67	0.79	0.28	**0.24**	**1.35**	0.33
319	3359	10/3/2017	1.10	0.80	0.27	**0.27**	**1.34**	0.34
320	3371	11/7/2017	0.68	0.82	0.28	**0.26**	**1.37**	0.34
321	3379	12/12/2017	1.05	0.80	0.27	**0.25**	**1.34**	0.34
322	3383	1/9/2018	0.58	0.79	0.27	**0.26**	**1.33**	0.35
323	3398	2/6/2018	**0.23**	0.79	0.27	**0.24**	**1.33**	0.39
324	3402	2/27/2018	0.68	0.75	0.29	**0.16**	**1.33**	0.38
325	3416	4/10/2018	0.58	0.72	0.28	**0.17**	**1.27**	0.37
326	3421	5/1/2018	0.54	0.69	0.26	**0.18**	**1.21**	0.38
327								

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 6
Stock Sol. ID 2B 068 -02
Organism ID: FHM 1982
Waterbath/incubator Used: # 7 (moved to WB4 on 5-7-18 by BAM)
Test Container Size: 800 ml
Date Initiated 5/2/20 18 Time 15:02
Date Terminated 5/9/20 18 Time 11:40
Solution Volume / rep: 500 ml

Client: QA / QC - RefTox
Sample Description: KCl (50 g/L stock)

Tech: Day 0 ~~0~~ L Day 1 BAM/L Day 2 BM Day 3 BAM Day 4 BAM Day 5 BAM Day 6 ~~C~~/BAM Day 7 B
Time: Day 0 1500 Day 1 1040 Day 2 1520 Day 3 1154 Day 4 1215 Day 5 1350 Day 6 1300 Day 7 1140

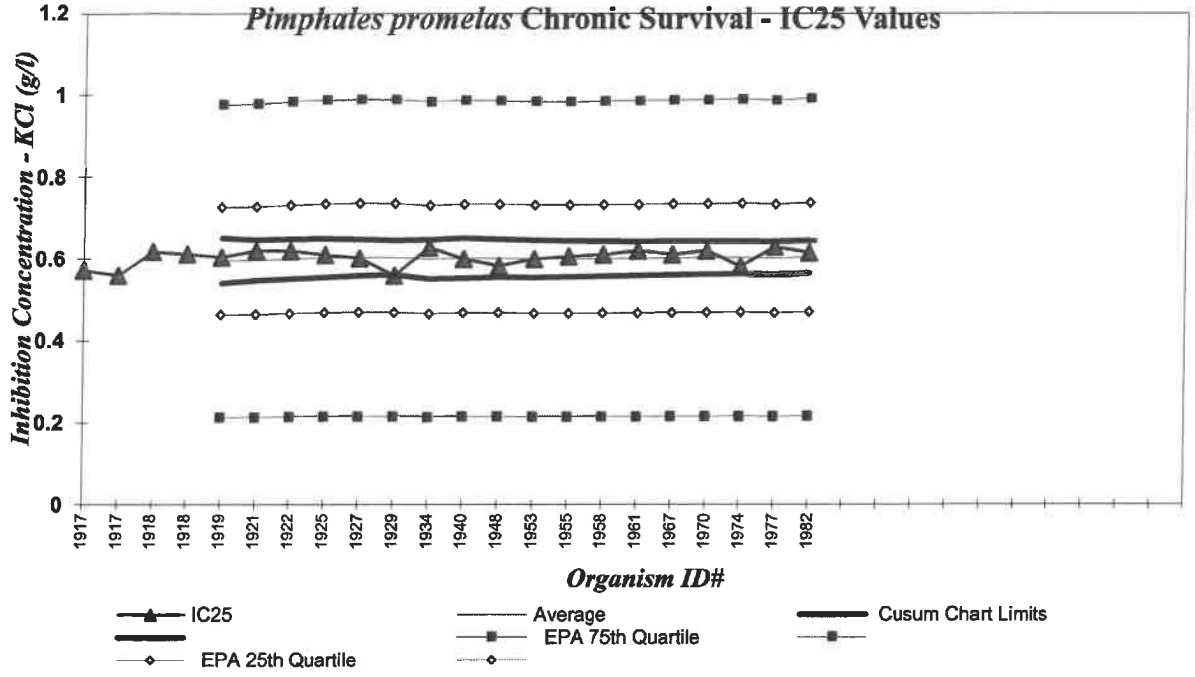
Conc. or Percent	Day	Number of Live Organisms A	B	C	D	Dissolved O_2 (mg/l) Pre	Post	pH Pre	Post	Temp. (°C) Pre	Therm. ID #	Conductivity (µS) Post (daily)
Control	0	10	10	10	10		7.5		7.1	Post: 24.8	250	343
	1	10	10	10	10	7.4	7.8	7.3	7.9	24.5	252	338
	2	10	10	9	10	7.4	8.1	7.6	7.9	24.4	252	339
	3	10	10	9	10	7.0	7.9	7.3	7.9	24.5	252	301
	4	10	10	9	10	6.4	8.1	7.3	7.8	24.7	251	334
	5	10	10	9	10	6.6	7.8	7.3	7.8	24.7	251	363
	6	10	10	9	10	6.9	7.8	7.4	7.8	24.1	252	366
	7	10	10	9	10							
0.25 g/L	0	10	10	10	10		7.7		7.3	Post: 24.8		822
	1	10	10	10	10	6.9	8.2	7.4	7.9	24.6		817
	2	10	10	10	10	7.1	8.2	7.6	7.9	24.3		823
	3	10	10	10	10	7.1	7.9	7.4	7.9	24.5		742
	4	9	10	10	10	6.5	8.0	7.3	7.8	24.6		805
	5	9	10	10	9	7.0	8.0	7.3	7.9	24.5		803
	6	9	10	10	9	7.1	8.0	7.4	7.8	24.3		849
	7	9	10	10	9							
0.50 g/L	0	10	10	10	10		7.7		7.3	Post: 24.7		1247
	1	10	10	10	10	7.0	8.2	7.5	7.9	24.8		1282
	2	10	10	10	10	7.0	8.0	7.6	8.0	24.5		1264
	3	10	10	10	9	6.6	8.0	7.5	7.9	24.4		1260
	4	10	10	10	9	6.5	8.2	7.4	7.9	24.6		1248
	5	10	10	10	9	7.1	8.0	7.4	7.9	24.5		1280
	6	10	9	10	9	7.3	8.2	7.4	7.9	24.0		1307
	7	10	9	10	9							
1.0 g/L	0	10	10	10	10		7.8		7.3	Post: 24.8		2150
	1	5	4	6	5	7.1	8.2	7.6	8.0	24.7		2140
	2	5	4	6	5	6.9	7.9	7.6	8.0	24.4		2150
	3	4	3	6	5	6.6	8.0	7.5	8.0	24.6		2110
	4	3	2	4	5	6.6	8.2	7.5	8.0	24.8		2130
	5	2	2	4	5	7.2	8.1	7.6	8.0	24.8		2240
	6	2	1	1	1	7.1	8.2	7.4	7.9	24.0		2210
	7	2	1	1	1							
2.0 g/L	0	10	10	10	10		7.7		7.4	Post: 24.7		3300
	1	0	0	0	0	7.0	T	7.6	T	24.4		T
	2					T		T		T		
	3											
	4											
	5											
	6											
	7	T	T	T	T							
4.0 g/L	0	10	10	10	10		7.7		7.4	Post: 24.8		7106
	1	0	0	0	0	7.4	T	7.7	T	24.7		T
	2					T		T		T		
	3											
	4											
	5											
	6											
	7	T	T	T	T							

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.
Pre =Pre-renewal solutions. Post =Post-renewal solutions.
Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
(23.8) = Temp. out of recommended range

Endpoint	IC25	Cusum Chart Limits
Survival	0.62	0.57 to 0.64
Growth	0.53	0.45 to 0.73

Task Manager
Project Manager
QA Officer 5-25-18

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



Pimephales promelas **- Chronic (EPA Test Method 1000.0)**

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.03

25th Quartile CV (*warning limit*) = 0.11

75th Quartile CV (*warning limit*) = 0.32

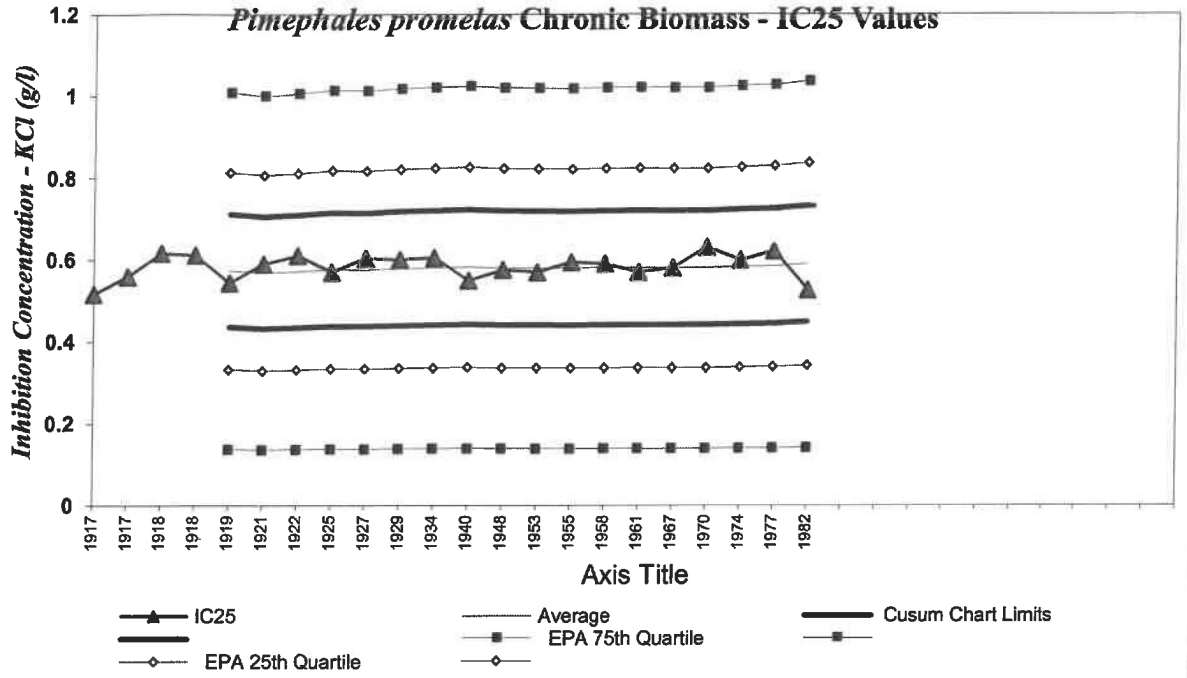
90th Quartile CV (*control limit*) = 0.52

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's),*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	FHM ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
8	1922	04/11/17	**0.62**	0.6	0.02	**0.55**	**0.65**	0.04
9	1925	05/09/17	**0.61**	0.60	0.02	**0.56**	**0.65**	0.04
10	1927	06/13/17	**0.60**	0.6	0.02	**0.56**	**0.65**	0.04
11	1929	06/20/17	**0.56**	0.6	0.02	**0.56**	**0.64**	0.03
12	1934	07/20/17	**0.63**	0.6	0.02	**0.55**	**0.65**	0.04
13	1940	08/01/17	**0.60**	0.6	0.02	**0.55**	**0.65**	0.04
14	1948	09/12/17	**0.58**	0.6	0.02	**0.56**	**0.65**	0.04
15	1953	10/10/17	**0.60**	0.6	0.02	**0.56**	**0.65**	0.04
16	1955	11/07/17	**0.61**	0.6	0.02	**0.56**	**0.64**	0.04
17	1958	12/12/17	**0.61**	0.6	0.02	**0.56**	**0.64**	0.04
18	1961	01/17/18	**0.62**	0.6	0.02	**0.56**	**0.64**	0.03
19	1967	02/06/18	**0.61**	0.6	0.02	**0.56**	**0.64**	0.03
20	1970	02/27/18	**0.62**	0.6	0.02	**0.56**	**0.64**	0.03
21	1974	03/20/18	**0.58**	0.6	0.02	**0.56**	**0.64**	0.03
22	1977	04/03/18	**0.63**	0.6	0.02	**0.56**	**0.64**	0.03
23	1982	05/02/18	**0.62**	0.6	0.02	**0.57**	**0.64**	0.03

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



Pimephales promelas **- Chronic (EPA Test Method 1000.0)**

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Growth (Biomass)

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.12

25th Quartile CV (*warning limit*) = 0.21

75th Quartile CV (*warning limit*) = 0.38

90th Quartile CV (*control limit*) = 0.45

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	FHM ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
8	1922	4/11/2017	**0.61**	0.6	0.04	**0.43**	**0.71**	0.06
9	1925	5/9/2017	**0.57**	0.58	0.04	**0.44**	**0.72**	0.06
10	1927	6/13/2017	**0.60**	0.58	0.03	**0.44**	**0.71**	0.06
11	1929	6/20/2017	**0.60**	0.58	0.03	**0.44**	**0.72**	0.06
12	1934	7/20/2017	**0.61**	0.58	0.03	**0.44**	**0.72**	0.06
13	1940	8/1/2017	**0.55**	0.58	0.03	**0.44**	**0.72**	0.05
14	1948	9/12/2017	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
15	1953	10/10/2017	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
16	1955	11/7/2017	**0.59**	0.58	0.03	**0.44**	**0.72**	0.05
17	1958	12/12/17	**0.59**	0.58	0.03	**0.44**	**0.72**	0.05
18	1961	01/17/18	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
19	1967	02/06/18	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
20	1970	02/27/18	**0.63**	0.58	0.03	**0.44**	**0.72**	0.05
21	1974	03/20/18	**0.60**	0.58	0.03	**0.44**	**0.72**	0.05
22	1977	04/03/18	**0.62**	0.58	0.03	**0.44**	**0.72**	0.04
23	1982	05/02/18	**0.53**	0.59	0.02	**0.45**	**0.73**	0.05

APPENDIX C

CHAIN OF CUSTODY

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: 153990-01 Date Received: 5-1-18

Client/Project: Energy NW Received By:

Were custody seals intact?	☒ Yes	☐ No	☐ N/A
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 7-18-18 2.7 °C	☑ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)	☑ Yes	☐ No	☐ N/A
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A
Are all samples within 36 hours of collection?	☑ Yes	☐ No	☐ N/A

Method of Shipment: ☐ Hand Delivered ☐ FedEx ☐ UPS ☒ Greyhound ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client Energy Northwest
Address PO Box 968
Richland WA 99352

Contact Person: Jane LePage
Phone: 509.377.4061

Project # Contract 344765

NPDES# WA0025515-1
Composite Sample Information
Samples/Hour ____ Volume/Sample ____
Total Hours ____ Total Volume ~20L Grab
Initiated: Date ____ Time ____
Ended: Date 043018 Time 05:27
Chilled During Collection Y

Ship Samples to: PO#

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N) ____
Temp. Upon Arrival (°C) ____
Check Ammonia (Y/N) ____ Dechlorinated (Y/N) ____

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
181063-01	04/30/18	0527		X	1	B3990-01	X	X		X														

Sampled By & Title (Please sign and print name) Jane LePage, Env. Scientist	Date/Time 043018 / 0527	Relinquished By (Please sign and print name) Jane LePage	Date/Time 043018 / 1315
Received By (Please sign and print name) [illegible]	Date/Time 5-1-18 1030	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via (UPS) Bis Fed-Ex Hand Other	Shipping #
Work Authorized By (Please sign and print name)	Remarks Sealed Cooler delivered to Shipping dept 2.7°C		

COC_Bioassay.xls
Doc Control ID: ASL612-0717

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99353
Contact Person: Jane LePage
Phone: 509. 377-4061
Project #: Contract# 344765

NPDES# WA002515-1
Composite Sample Information:
Samples/Hour: Volume/Sample:
Total Hours: Total Volume: ~ 20L Grab
Initiated: Date: Time:
Ended: Date: 050218 Time: 0520
Chilled During Collection: 4

Ship Samples to:
PO#

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
181063-02	050218	0520		X	1	B3990-02		X		X														

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Jane LePage Env. Scientist	050218/0520	Jane LePage	050218/1315
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #
Work Authorized By (Please sign and print name)	Remarks: Sealed cooler delivered to shipping dept		

B3990 B TH173 ODS: 2.3 COR: 2.2°C

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3990 B

Client/Project: Energy Northwest

Date Received: 5/3/18

Received By: PC

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 7/18/18	2.2 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	
Method of Shipment:	☐ Hand Delivered	☐ FedEx	☒ UPS	☐ Greyhound	☐ Other: _____	☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3990 03 Date Received: 5-5-18

Client/Project: ENV Received By:

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 7-18-18	3.1 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	
Method of Shipment:	☐ Hand Delivered ☐ FedEx ☒ UPS ☐ Greyhound ☐ Other: _____		☐ N/A	

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968, Richland WA 99353
Contact Person: Jane LePage
Phone: 509.377.4061
Project #:

NPDES#: WA002515-1
Composite Sample Information:
Samples/Hour: Volume/Sample: ~20L
Total Hours: Total Volume:
Initiated: Date: Time:
Ended: Date: 050418 Time: 0515
Chilled During Collection: Y

Ship Samples to: PO# 344765
TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
181063.03	050418	0515		X	1	13990-05		X		X														

Sampled By & Title: Jane LePage Environ. Scientist	(Please sign and print name)	Date/Time: 050418 / 0515	Relinquished By: Jane LePage	Date/Time: 050418 1300
Received By: [illegible]	(Please sign and print name)	Date/Time: 5-5-18 1220	Relinquished By	Date/Time
Received By	(Please sign and print name)	Date/Time	Relinquished By	Date/Time
Received By	(Please sign and print name)	Date/Time	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #: 1Z6TV4044454127840
Work Authorized By	(Please sign and print name)	Remarks: Saturday Delivery - Package dropped @ UPS Store		

COC_Bioassay.xls
Doc Control ID: ASL612-0717

AARON HILL
(509) 377-4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

74 LBS

1 OF 1

AH

SHIP TO:
BRETT MUCKEY
(541) 243-6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330-4741

H

OR 973 1-01

UPS NEXT DAY AIR

1S

TRACKING #: 1Z 69V 404 44 5412 7840

BILLING: P/P

REF 1:environmental lab

WS 20.0.20 Zebra ZP 450 99.0A 04/2018

CH2MHILL **CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING**

Client Energy Northwest
Address PO Box 968
Richland WA 99354

Contact Person: Jane LePage
Phone: 509-377-4061
E-mail: jt lepage@energy-northwest.com

CH2M HILL Project # / Purchase Order # 344765

NPDES# WA002515-1

Composite Sample Information:
Initiated: Date ____ Time ____
Ended: Date 050718 Time 0515
Chilled During Collection ? Yes X No ____
Dechlorinated prior to shipping ? Yes ____ No X

Ship Samples to:
CH2M HILL - Applied Sciences Laboratory
Attention: Bioasssay Lab
1100 NE Circle Blvd. Suite 300
Corvallis, OR 97330
Lab Phone: (541) 768-3160
Customer Service: (541) 768-3120

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Green Algae	Trout Acute	Sheepshead Acute	Sheepshead Chronic	Menidia Acute	Menidia Chronic	Mysid Acute	Mysid Chronic	Haz Waste				Concentration and/or Comments
181063-04	050718	0515		X	1	B340-04		X	X	X													Chronic
								X	NO														Renewal

Sampled By & Title (Please sign and print name): Jane LePage Env. Scientist	Date/Time: 050718 0515	Relinquished By (Please sign and print name): Jane LePage	Date/Time: 050718 1300
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name): Brett Mudge TA-ASL	Date/Time: 5-8-18 1035	Shipped Via: UPS X Bus ___ Fed-Ex ___ Hand ___ Other ___	Shipping #:
Work Authorized By (Please sign and print name):	Remarks: Delivered Sealed cooler to Shipping dept.		

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B3990-04
Client/Project: Energy NW

Date Received: 5-8-18
Received By: BM

Were custody seals intact?		☒ Yes	☐ No	☐ N/A
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp.	3.6 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?		☒ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)		☒ Yes	☐ No	☐ N/A
Were the sample containers in good condition (not broken or leaking)?		☒ Yes	☐ No	☐ N/A
Are all samples within 36 hours of collection?		☒ Yes	☐ No	☐ N/A

Method of Shipment: ☐ Hand Delivered ☐ FedEx ☐ UPS ☐ Greyhound ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

BIOASSAY REPORT

CHRONIC
BIOASSAYS CONDUCTED
July 26 through August 2, 2018

Prepared for

ENERGY NORTHWEST
RICHLAND, WASHINGTON

Prepared by

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
ASL

1100 NE Circle Boulevard, Suite 310
Corvallis, Oregon 97330
541-207-0995

NELAC #OR100022
State of Washington Department of Ecology (WDOE), Lab ID C1233
California State Environmental Laboratory Accreditation Program, Certificate No.: 1726

Revised Report Date: September 6, 2018
Original Report Date: August 22, 2018
Lab I.D. No. B4049-chr

CONTENTS

INTRODUCTION

TestAmerica ASL (TA-ASL) – Bioassay Laboratory conducted chronic bioassays using the *Pimephales promelas* (fathead minnow) and the water flea (*Ceriodaphnia dubia*), on samples provided by Energy Northwest, Richland, Washington. The tests were conducted from July 26 through August 2, 2018.

Also note that acute testing using the *Pimephales promelas* (fathead minnow) was also initiated at this time. As per client request, the acute results will be reported separately.

Revision 1 of this report was to address typographical errors (testing dates) and to clarify the amount of sodium thiosulfate added to the sample collected on July 30 (twice as much as needed due to lab error – see Deviation section).

OVERVIEW OF REGULATORY GUIDANCE

The following provides an overview and excerpts of applicable permit specifics, regulatory guidance, and other relevant information. This is intended only as a helpful guide, from a laboratory perspective, for understanding test outcomes. The final responsibility for interpretation of results remains with the client and/or regulatory agency.

The following guidance is taken from TA-ASL's reading of the NPDES permit for Energy Northwest's Columbia Generating Station in Richland, WA (permit #WA002515-1, effective Nov 1, 2014, expires Oct 31, 2019, modified Feb 8, 2016).

Chronic toxicity:

Testing:

- "Conduct chronic toxicity testing … once per quarter in the year prior to submission of the application for permit renewal."
- "Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 11% effluent. The series of dilutions should also contain the CCEC of 1% effluent."
- "The CCEC equals 1% effluent."

Sampling and Reporting Requirements:

- "The permittee must collect grab samples … must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion."
- "The lab must begin the toxicity testing … no later than 36 hours after sampling was completed."

- "The Permittee must chemically dechlorinate final effluent … with sodium thiosulfate just prior to test initiation. Do not add more sodium thiosulfate than is necessary to neutralize the chlorine. Provide in the test report the calculations to determine the amount of sodium thiosulfate necessary …"

The following is taken from the WDOE guidance (WQ-R-95-80, June 2016 revision):

"To reduce WET limit violations (and anomalous concentration-response relationships) due to statistical significance that is a Type I error [false positive], we lower alpha when differences in test organism response are small."

"Alpha will be lowered from 0.05 to 0.01 if a … 20% difference in a chronic test is significant."

SUMMARY OF TEST RESULTS

Exhibit 1 provides a summary of the final test results.

EXHIBIT 1
Summary of Chronic Test Results

Species	NOEC (%)	LOEC (%)	IC_{25} (%)
C. dubia	11.0	33.0	19.8
P. promelas	100	> 100	> 100

Note: acronyms are as defined below.

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

More detailed information is provided in the Results and Discussion section.

ACRONYM DEFINITIONS (from EPA guidance):

NOEC = No Observed Effect Concentration: The highest test concentration that causes no observable adverse effects on the test organisms (i.e. no statistically significant reduction from the control).
LOEC = Low Observed Effect Concentration: The lowest test concentration that does cause an observable adverse effect on the test organisms (i.e. is statistically significant reduction from the control).
IC_{25} = Inhibition Concentration (25%): A point estimate of the test concentration that would cause a 25 percent reduction of a non-quantal biological measurement (i.e. growth, reproduction, etc.) for the test population.

SAMPLE INFORMATION

Exhibit 2 provides a summary of the sample conditions as received.

EXHIBIT 2
Sample Conditions on Receipt

Sample ID	**190086**		
TA-ASL SDG + suffix	B4049 -01	-02	-03
Collection - Date and Time	07/25/2018 03:18	07/27/2018 03:35	07/30/2018 13:45
Receipt - Date and Time	07/26/2018 10:55	07/28/2018 11:20	07/31/2018 10:30
Temperature (^{o}C)	3.2	3.2	2.2
Dissolved Oxygen (mg/L)	8.0	8.8	8.1
pH	7.9	8.0	7.6
Conductivity (S/cm)	1176	1125	878
Total Residual Chlorine (mg/L)	0.04	0.04	0.02
Ammonia (mg/L as NH_3-N)	< 0.10	< 0.10	< 0.10
Total Hardness (mg/L as $CaCO_3$)	510	630	650
Total Alkalinity (mg/L as $CaCO_3$)	75	105	95

Water quality measurements during testing remained within test design limits as prescribed by EPA and WDOE, except as noted with the individual test results. (see the Results and Discussion section)

METHODS AND MATERIALS

TEST METHODS

The chronic test methods were performed according to: *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, (2002), EPA-821-R-02-013.

Additional guidance was provided by:

Whole Effluent Toxicity Testing Guidance and Test Review Criteria, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

DEVIATIONS FROM PROTOCOLS

Deviations from required procedures in the test methods:

None noted.

Deviations from recommended procedures in the test methods:

The amount of Sodium Thiosulfate (dechlorinating agent) added to the sample collected on July 30 was based off of the initial Total Residual Chlorine reading of 0.04 mg/L. This reading was later corrected to 0.02 mg/L. As a result of this lab error, twice the specified amount of sodium thiosulfate was added to the sample prior to use. During interpretation of the impact of this deviation, it should be noted that the dosage amount of Sodium Thiosulfate used in the July 30 sample was the same dosage as used during sample preparation steps for the July 25 and 27 samples. It is TA-ASL's professional opinion that this deviation had minimal or no significant effect on testing results.

TEST DESIGN

The following summarizes the conditions used for both overall testing and the specifics for each test (observations and notations can be found on the datasheets in Appendix A):

Overall Test Design:

Chronic tests: 1.0, 3.3, 11.0, 33.0, and 100 percent sample + dilution water for the control.

Test Organism Conditions:

All organisms tested were fed and maintained during culturing, acclimation, and testing as prescribed by the EPA (2002).

The test organisms appeared vigorous and in good condition prior to testing.

C. dubia chronic test:

Source: TA-ASL's in-house cultures
Age: Less than 24 hours old and within an 8-hour age range, with blocking by known parentage
Design: Ten test vessels per concentration, one organism per vessel
Test Solution Renewal: Daily
Monitoring:

- Daily: Survival and neonate production (with brood determination)
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination:

- Survival: @ after 7 days.
- Reproduction: When 60%+ of surviving control organisms produce a 3rd brood.

Endpoints: Survival (at Day 7) and Reproduction (through first 3 broods)

P. promelas chronic test:

Source: Aquatox Inc., Hot Springs, Arkansas
Age: Less than 48 hours old and within an 24 hour age range
Design: Four test vessels per concentration, ten organisms per vessel
Test Solution Renewal: Daily
Monitoring:

- Daily: Survival
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination: 7 days after test initiation.
Endpoints: Survival and Growth (average dry weight per organism added @ initiation)

DILUTION WATER

The dilution water used was the standard culture water used by TA-ASL:

Reconstituted, moderately hard water (as per EPA protocol) with a total hardness of 80 to 100 mg/L as $CaCO_3$ and an alkalinity of 60 to 70 mg/L as $CaCO_3$.

SAMPLE COLLECTION AND STORAGE

Samples were collected by Energy Northwest personnel. The samples were accepted as scheduled by TA-ASL. Chain of Custody and Sample Receipt Records are provided in Appendix C.

All samples were received within the EPA recommended 0 to 6 ^{o}C range.

All samples were received within the WDOE required 0 to 6 °C range.
All samples were initially used for test initiation or test solution renewal within the EPA recommended maximum holding time of 36 hours of sample collection.
All subsequent uses of a sample occurred within the EPA recommended maximum holding time of 72 hours past the time of initial use of that sample.
All subsequent uses of a sample occurred within the WDOE recommended maximum holding time of 72 hours past the time of sample collection.
Following receipt, the samples were stored in the dark at 0 to 6 C until test solutions were prepared and tested.

SAMPLE PREPARATION

Samples used during these tests were:

Temperature adjusted prior to test initiation and each daily renewal.
Dechlorination with sodium thiosulfate was performed.

DATA ANALYSIS

The statistical analyses performed for the chronic tests were those outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, USEPA Office of Water, Fourth Edition (EPA 2002), EPA-821-R-02-013, using CETIS.

Additional guidance was provided by *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

The specific statistical analysis and CETIS version used for each endpoint evaluation is listed with the statistical outputs included with each test in Appendix A.
If any additional analysis methods were also used, an explanation of the rationale and reference to the source method is included with the presentation of those results below.

RESULTS AND DISCUSSION

The raw data sheets are presented in Appendix A.

CHRONIC BIOASSAYS

Table 1 summarizes the survival and reproduction data for the *C. dubia* chronic test initiated on July 26, 2018.

Table 1
Summary of Chronic Results
C. dubia

Sample Concentration (%)	Percent Survival	Mean Number of Young Per Adult
Control	100	26.9
1.0	100	24.4
3.3	100	28.3
11.0	100	26.5
33.0	60	14.6 [a]
100	30 [a]	1.5

[a] Indicates a statistically significant difference from the control at alpha = 0.05.

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 11.0 %
LOEC = 33.0 %
IC_{25} = 19.8 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *C. dubia* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum 15 young produced per surviving control adult. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

Table 2 summarizes the survival and growth data for the *P. promelas* chronic test initiated on July 26, 2018.

Table 2
Summary of Chronic Results
P. promelas

Sample Concentration (%)	Percent Survival	Mean Dry Weight Per Organism Added (mg)
Control	95.0	1.003
1.0	95.0	0.944
3.3	95.0	1.024
11.0	100	0.970
33.0	97.5	0.950
100	95.0	1.024

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 100 %
LOEC > 100 %
IC_{25} > 100 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *P. promelas* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum weight of 0.250 mg per surviving control organism. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

REFERENCE TOXICANT TESTS

Reference toxicant (reftox) testing is performed to document both initial and ongoing laboratory performance of the test method(s). While the health of the test organisms is primarily evaluated by the performance of the laboratory control, reftox test results also may be used to assess the health and sensitivity of the test organisms. Reftox test results within their respective cumulative summary (Cusum) chart limits are indicative of consistent laboratory performance and normal test organism sensitivity.

The results of the reftox tests indicate that the test organisms were within their respective cusum chart limits based on EPA guidelines. This demonstrates ongoing laboratory proficiency of the test methods and suggests normal test organism sensitivity in the associated client testing.

The *C. dubia* chronic reftox test was conducted using sodium chloride. The *P. promelas* chronic reftox test was conducted using potassium chloride. The data sheets for the reference toxicant tests are provided in Appendix B.

Table 3 summarizes the reference toxicant test results and Cusum chart limits.

Table 3
Chronic Reference Toxicant Tests (g/L)

Species	IC_{25}	Cusum Chart Limits
C. dubia (survival)	1.54	1.15 to 2.17
C. dubia (reproduction)	0.79	0.17 to 1.25
P. promelas (survival)	0.61	0.57 to 0.64
P. promelas (growth)	0.53	0.44 to 0.73

APPENDIX A

RAW DATA SHEETS

TestAmerica

FRESHWATER TOXICITY TEST: SAMPLE AND DILUTION WATER DATA

Client: Energy Northwest — SDG # B 4049 — Test Initiation: Date 7-26-18

Contact: Jane LaPage (509) 377-4061 — Test Termination: Date 8-2-18

Sample ID Number	Field ID	Collected Date (mm/dd/yy)	Collected Time (Pacific Zone)	Received Date (mm/dd/yy)	Received Time (Pacific Zone)	Temp (°C) as Rc'vd	Total Residual Chlorine (mg/l) ☑ Dechlorination allowed as Rc'vd / after Dechlor.	Ammonia NH_3-N mg/l as Rc'vd	Hardness mg/l as $CaCO_3$ as Rc'vd	Alkalinity mg/l as $CaCO_3$ as Rc'vd	DO (mg/L) as Rc'vd	pH as Rc'vd	Cond. (uS) as Rc'vd	60 um filtered? (organisms noted)
B4049 -01	190086-01	07/25/18	03:18	07/26/18	10:55	3.2	0.04 / 0.04	<0.10	510	75	8.0 BM	7.9 BM	1176 BM	☐
-02	190086-02	7/27/18	03:35	7/28/18	11:20	3.2	0.04 / 0.04	<0.10	630	105	8.8	8.0	1125	☐
-03	190086-03	07/30/18	13:45	07/31/18	10:30	2.2	0.042 / 0.042 Rec BAM 7-31-18	<0.10	650	95	BAM 8.1	BAM 7.6	878 BAM	☐
							/							
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							/							
							/							
			Reporting Limits:			na	0.02 mg/L	0.10 mg/L	5 mg/L	5 mg/L	na	na	na	na

Note: "-" Indicates data collection or dechlorination not needed. Any other adjustments to samples prior to use are documented in Comments below or on Dilutions **page.**

Dilution Water	ID#	Hardness mg/l as $CaCO_3$	Alkalinity mg/l as $CaCO_3$
Recon MH (FHM)	4694	92	66
	4695	88	65
	4696	96	67

Comments: ☑ Indicates the action was taken, (☐= action not taken): " - " = sample not dechlorinated, or analyte not collected/needed.

☑ Dechlorination is **REQUIRED** if Total Residual Chlorine (TRC) is detected (i.e. TRC is 0.02 mg/L or greater).

From EPA manual (EPA-821-R-02-013, 8.8.7): 0.025 ml of a 26.8 g/L stock of sodium thiosulfate will reduce 0.10 mg/L TRC in a 1L sample.

(for example: **4L** of sample at **0.10** mg/L TRC needs **0.10** ml of 26.8g/L sodium thiosulfate stock to be dechlorinated)

-01 sample Calc: (20 L sample) x (0.04 mg/L TRC) x 0.25 = 0.20 ml of 26.8 g/L sodium thiosulfate to add (ID: 28070-04)

-02 sample Calc: (21 L sample) x (0.04 mg/L TRC) x 0.25 = 0.21 ml of 26.8 g/L sodium thiosulfate to add (ID: 28070-04)

-03 sample Calc: (20 L sample) x (0.04 mg/L TRC) x 0.25 = 0.20 ml of 26.8 g/L sodium thiosulfate to add (ID: 28070-04)

DO NOT add more sodium thiosulfate if "after Dechlor" TRC reading is not reduced to < 0.02 mg/L. Leave as is.

Water Quality Meters Used/ID#: Dissolved Oxygen # 4 pH # 11 Conductivity # 2

TestAmerica
THE LEADER in ENVIRONMENTAL TESTING

FRESHWATER TOXICITY TEST: TEST ORGANISM INFORMATION

Client: Energy Northwest

Sample Designation (SDG): B 4044

Test Species Information	Cd # 3446 *Ceriodaphnia dubia* Chronic	FHM # 1995 *Pimephales promelas* Chronic	FHM # 1995 *Pimephales promelas* Acute		
Organism Age at Initiation	<24 hrs, all within an 8 hr window	<48 hrs, all within a 24 hour window	1 Days, within a 24 hour window		
Test Container Size	30 ml	800 ml	400 ml		
Test Volume	15 ml	500 ml	250 ml		
Feeding: Type and Amount	0.10 ml Algae and 0.10 ml YCT daily	0.15 ml *Artemia*, 2 x Daily	0.15 ml *Artemia*, @ 48 hrs		
Aeration: In Test Chambers via Slow Bubble :	☒ None ☐ Prior to use	☒ None ☐ Prior to use ☐ @ _____ hrs	☒ None ☐ Prior to use ☐ @ _____ hrs		
Acclimation Period	<24 hrs	<24 hrs	<24 hrs		
Organism Source	In-House	Aquatox	Aquatox		
Size	-	-	-		
Loading Rate	-	-	-		

Dissolved Oxygen aeration justifications (in test chambers):

Test(s): ☐ All ☐ _____

Date:

Comments:

Test Solution Preparation and Dilution Record

Client: Energy Northwest

Note: ☐ Indicates task not done, ☑ Indicates task was done. Temp adj. = Temperature adjusted to ambient or test temp

Ditto marks (") indicate that the same SDG, batch of dilution water, or food as the previous day's entry was used.

Ceriodaphnia dubia - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	200
1.0	2.00	→	200
3.3	6.60	→	200
11.0	22.0	→	200
33.0	66.0	→	200
100	200	→	200

Total Sample volume needed per day = 297 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	YCT ID Used	Algae ID Used	Date	Time	Initials
0 (Initiation)	B 4049-01	☐ Temp adj, ☐ Aerated	ID # 4694	# 1168	# 1166	7/26/18	11:50	CD
1	B 4049-01	☐ Temp adj, ☐ Aerated	ID # 4695	# 1161	# 1166	7/27/18	9:20	EBS
2	B 4049-02	☐ Temp adj, ☐ Aerated	ID # 4695	# 1157	# 1166	7/28/18	12:15	EBS
3	B -02	☐ Temp adj, ☐ Aerated	ID # 4696	# 1157	# 1166	7/29/18	10:00	MB
4	B -02	☐ Temp adj, ☐ Aerated	ID # "	# 1168	# 1166	7/30/"	08:58	BM
5	B -03	☐ Temp adj, ☐ Aerated	ID # 4696	# 1176	# 1166	7/31/18	11:40	BAM
6	B -03	☐ Temp adj, ☐ Aerated	ID # 4696	115 # ~~1157~~	# 1166	8/1/18	09:50	BAM
7	B -	☐ Temp adj, ☐ Aerated	ID #	#	#	/ /	:	

Fathead minnow - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	2000
1.0	20.0	→	2000
3.3	66.0	→	2000
11.0	220	→	2000
33.0	660	→	2000
100	2,000	→	2000

Total Sample volume needed per day = 2966 mls

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
0 (Initiation)	B 4049-01	☐ Temp adj, ☐ Aerated	ID # 4694	7/26/18	11:50	CD
1	B 4049-01	☐ Temp adj, ☐ Aerated	ID # 4695	7/27/18	09:30	EBS
2	B -02	☐ Temp adj, ☐ Aerated	ID # 4696	7/28/18	12:25	EBS
3	B -02	☐ Temp adj, ☐ Aerated	ID # 4696	7/29/18	10:45	BAM
4	B -02	☐ Temp adj, ☐ Aerated	ID # "	7/30/"	08:58	BM
5	B -03	☐ Temp adj, ☐ Aerated	ID # 4696	7/31/18	11:30	BAM
6	B -03	☐ Temp adj, ☐ Aerated	ID # 4696	8/1/18	09:50	BAM

Fathead minnow - Acute

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	1000
6.25	62.5	→	1000
11.0	110	→	1000
25.0	250	→	1000
50.0	500	→	1000
100	1,000	→	1000

Test Day	Sample ID Used	Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
0 (Initiation)	B 4049-01	☐ Temp adj, ☐ Aerated	ID # 4694	7/26/18	11:50	CD
2	B -01	☐ Temp adj, ☐ Aerated	ID # 4695	7/28/18	08:30	CD

Total Sample volume needed per day = 1923 mls

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: Energy Northwest Test Start Date: 7-26-13

Sample Description: Initial Sample ID#: B 4049

Data summarized by: BM

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	24	26	28	35	27	31	26	23	23	26	10	269
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
1.0 %	21	23	19	23	26	23	27	29	27	26	10	244
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
3.3 %	25	24	25	31	31	28	29	33	25 26	32	10	283
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
11.0 %	20	25	31	27	27	32	25	26	27	25	10	265
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
33.0 %	21	24	10	27	15	4	18	6	16	5	6	146
	AD?	AD?	AD? ✓	AD?	AD?	AD? ✓	AD?	AD? ✓	AD?	AD? ✓		
100 %	0	0	0	5	0	0	0	5	0	5	3	15
	AD? ✓	AD? ✓	AD?	AD?	AD? ✓	AD? ✓	AD? ✓	AD?	AD? ✓	AD? ✓		

Survival data summarized through Day 7. 60%+ of surviving controls with 3+ broods first observed on Day 6.

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination (for WDOE only, = Number of test organisms alive at Day 7)

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

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CERIODAPHNIA CHRONIC SURVIVAL AND REPRODUCTION DATA

Neo's obtained from	A	B	C	D	E	F	G	H	I	J
Culture Board ID:	I	I	I	I	I	I	I	I	I	I
Slot #:	1	5	30	31	32	40	41	51	58	60

Incubator Used: # 6
Random Template Used: 6 conc # 10

Client: Energy Northwest
Test Initiation: Date: 7/26/2018 Time: 12:20
Sample Description:
Initial Sample ID # B4049-01
Termination: Date: 8/2/2018 Time: 11:40

Technician Day 0 MB Day 2 MB Day 3 MB Day 4 MB Day 5 MB Day 6 MB Day 7 BR Day 8
Time Day 0 1220 Day 2 1335 Day 3 1230 Day 3 1120 Day 4 1110 Day 5 1415 Day 6 1310 Day 7 1140 Day 8

Rec'd MB 7-27-18

Percent	Day	Daily Number of Live Young for each Replicate A	B	C	D	E	F	G	H	I	J	No. Live Adults	Daily Total Live Young
Control	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	4	5	5	0	4	5	3	3	0	0	10	29
	4	7	9	8	8	9	0	0	*08	4	5	10	58
	5	0	0	0	11	0	11	9	0	8	10	10	49
	6	13	12	15	16	14	15	14	12	11	11	10	133
	7	-	-	-	-	-	-	-	-	-	-	10	-
	8												
1.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	5	4	3	4	4	3	3	4	5	8	10	35
	4	4 AY	9	9	0	8	0	0	0	0	5	10	35
	5	0	0	0	9	0	9	10	13	10	10	10	61
	6	12	10	7	10	14	11	14	12	12	11	10	113
	7	-	-	-	-	-	-	-	-	-	-	10	-
	8												
3.3 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	3	4	3	5	6	4	4	5	4	0	10	40
	4	8	7	8	0	9	0	0	0	9	8	10	49
	5	12	0	0	12	0	11	10	12	0	11	10	68
	6	0	13	14	14	16	13	15	16	12	13	10	126
	7	-	-	-	-	-	-	-	-	-	-	10	-
	8												
11.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	4	5	0	4	4	5	4	4	4	0	10	~~35~~ 34
	4	7	8	6	8	0	0	0	0	0	4	10	33
	5	9	0	11	0	11	12	9	9	11	7	10	79
	6	0	12	14	15	12	15	12	13	12	14	10	119
	7	-	-	-	-	-	-	-	-	-	-	10	-
	8												
33.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	4	5	4	4	1	4	2	0	1	0	10	25
	4	6	9	6	8	7	0	0	6	6	5	10	53
	5	0	10	OAD	0	7	OAD	5	OAD	0	OAD	~~7~~ 6	22
	6	11	0	|	15	0	|	11	|	9	|	6	46
	7	-	-	|	-	-	|	-	|	-	|	6	-
	8			|			|		|		|		
Rec'd MB 7-27-18 100 %	1	~~10~~ 0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	0	0	0	0	0	0	0	0	10	0
	4	0	0	0 AY	4	0	0	0	3	0	1	10	8
	5	OAD	OAD	0 AY	0	OAD	OAD	OAD	0	OAD	4	4	4
	6	|	|	0 AY	1 AY	|	|	|	2	|	0 AD	3	3
	7	|	|	-	-	|	|	|	-	|	|	3	-
	8	|	|	|	|	|	|	|	|	|	|	|	|

"AD" = Adult Dead, "AY" = Aborted young, "M" = male organism, "F" = Female, "R" = Adult releasing young, " / " = split brood (carry-over brood / current day brood),
"Inj" = Adult Injured during test solution renewal, replicate removed from analysis. "AM" = Adult missing, remove from analysis. A circled neonate count = 4th brood

Footnote: As per WDOE, C. dubia test reproduction should be when 60% of the surviving control organisms have produced their third brood (Days 6, 7, or 8). Survival is at seven days.

TestAmerica

CERIODAPHNIA WATER QUALITY DATA

Client: Energy Northwest
Sample Description:
Initiated Date 7/26/2018 Time 12 : 20
Initial Sample ID # B 4049 - 01
Adults Isolated Date 7/25/2018 Time 13 : 00
Neo's Collected Date 7/25/2018 Time 19 : 40

Tech:	Day 0 MB	Day 1 MB	Day 2 [illegible]	Day 3 MB	Day 4 MB	Day 5 MB	Day 6 MB/[illegible]	Day 7 [illegible]	Day 8
Time	Day 0 12 : 50	Day 1 12 : 55	Day 2 14 : 10	Day 3 13 : 00	Day 4 12 : 00	Day 5 15 : 20	Day 6 16 : 25	Day 7 12:30	Day 8 :
Therm.	Day 0 # 252	Day 1 # 252	Day 2 # 252	Day 3 # 252	Day 4 # 252	Day 5 # 252	Day 6 # 251	Day 7 # 251	Day 8 #

Dissolved Oxygen (mg/l)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.5	7.8 / 7.6	7.6 / 7.8	7.5 / 7.4	7.6 / 7.5	7.0 / 7.3	7.5 / 8.0	7.2	
1.0 %	7.7	7.7 / 7.8	7.8 / 7.8	7.7 / 7.5	7.7 / 7.7	7.0 / 7.5	7.4 / 7.7	7.7	
3.3 %	7.8	7.9 / 7.9	7.8 / 7.7	7.8 / 7.7	7.8 / 7.9	7.1 / 7.5	7.5 / 7.7	7.7	
11.0 %	7.9	7.8 / 7.9	7.7 / 7.8	7.9 / 7.7	7.8 / 8.1	7.2 / 7.5	7.6 / 7.4	7.2	
33.0 %	7.9	7.9 / 7.9	7.8 / 7.8	7.9 / 7.8	7.9 / 8.1	7.2 / 7.4	7.3 / 7.2	6.2	
100 %	8.0	7.8 / 7.8	7.9 / 7.8	7.9 / 7.9	7.9 / 8.2	7.2 / 7.3	7.6 / 7.2	6.3	

pH

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.9	7.8 / 7.7	7.7 / 7.9	7.5 / 7.6	7.5 / 7.5	7.8 / 7.6	8.3 / 8.4	7.2	
1.0 %	7.9	7.7 / 7.8	7.8 / 7.9	7.6 / 7.7	7.6 / 7.7	7.8 / 7.7	8.2 / 8.2	7.3	
3.3 %	7.9	7.8 / 7.8	7.8 / 7.9	7.6 / 7.7	7.6 / 7.7	7.8 / 7.7	8.1 / 8.1	7.3	
11.0 %	7.9	7.8 / 7.8	7.8 / 7.9	7.6 / 7.7	7.6 / 7.7	7.8 / 7.7	8.1 / 8.0	7.4	
33.0 %	7.9	7.8 / 7.8	7.8 / 7.8	7.6 / 7.7	7.6 / 7.7	7.8 / 7.8	8.0 / 8.0	7.5	
100 %	7.9	7.6 / 7.8	7.8 / 7.8	7.6 / 7.6	7.6 / 7.6	7.7 / 7.7	8.1 / 8.0	7.6	

Temperature (°C) / Conductivity (µS) (1st use of each sample only)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	24.1 / 334	25.2	24.4 / 313	25.1	25.2	25.2 / 349	25.1	25.8	
1.0 %	24.1 / 351	24.7	24.1 / 328	25.6	24.5	24.9 / 354	25.3	25.9	
3.3 %	24.2 / 315	25.3	24.1 / 346	25.5	25.0	25.3 / 378	25.5	26.0	
11.0 %	24.1 / 458	24.4	24.4 / 412	24.5	24.9	25.2 / 414	25.3	25.1	
33.0 %	24.1 / 657	24.6	24.2 / 584	24.4	24.2	24.7 / 579	25.1	25.6	
100 %	25.4 / 1177	24.6	24.7 / 1116	24.5	25.3	24.6 / 987	24.3	25.0	

COMMENTS: Temperatures taken just prior to test solution renewals. DO, pH, and Conductivity taken following organism transfer.

(23.8) = Temp out of recom. range

Note: All Day 0 data represents conditions at initiation. All other days: numerator represents pre-renewal conditions, denominator represents post-renewal conditions.

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Batch ID:	03-5016-1143	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 12:20	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 11:40	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01 ✓	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151) ✓		
Sample Age:	33h	**Station:**			

Test Note: As per WDOE, survival data through Day 7, reproduction data through when 60%+ of the controls had 3 broods (Day 6).

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
02-4011-2136	7d Survival Rate	33	100	57.45	NA	3.03	Fisher Exact/Bonferroni-Holm Test
15-4589-1688	Reproduction	11	33	19.05	17.5%	9.091	Steel Many-One Rank Sum Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
04-4201-9022	Reproduction	IC25	19.79	15.47	26.68	5.054	Linear Interpolation (ICPIN)
		IC50	36.41	25.67	46.65	2.746	

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
02-4011-2136	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
04-4201-9022	Reproduction	Control Resp	26.9	15 - NL	Yes	Passes Acceptability Criteria
15-4589-1688	Reproduction	Control Resp	26.9	15 - NL	Yes	Passes Acceptability Criteria ✓
15-4589-1688	Reproduction	PMSD	0.1751	0.13 - 0.47	Yes	Passes Acceptability Criteria

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	1	1	1	1	1	0	0	0.0%	0.0%
1		10	1	1	1	1	1	0	0	0.0%	0.0%
3.3		10	1 ✓	1	1	1	1	0	0	0.0%	0.0%
11		10	1	1	1	1	1	0	0	0.0%	0.0%
33		10	0.6	0.2306	0.9694	0	1	0.1633	0.5164	86.07%	40.0%
100		10	0.3	0	0.6456	0	1	0.1528	0.483	161.0%	70.0%

Reproduction Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	26.9	24.24	29.56	23	35	1.178	3.725	13.85%	0.0%
1		10	24.4	22.18	26.62	19	29	0.9798	3.098	12.7%	9.29%
3.3		10	28.3 ✓	25.89	30.71	24	33	1.065	3.368	11.9%	-5.2%
11		10	26.5	24.11	28.89	20	32	1.057	3.342	12.61%	1.49%
33		10	14.6	8.777	20.42	4	27	2.574	8.14	55.76%	45.72%
100		10	1.5	-0.2278	3.228	0	5	0.7638	2.415	161.0%	94.42%

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	0	1	1	0	1	0	1	0
100		0	0	1	1	0	0	0	1	0	0

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	24	26	28	35	27	31	26	23	23	26
1		21	23	19	23	26	23	27	29	27	26
3.3		25	24	25	31	31	28	29	33	25	32
11		20	25	31	27	27	32	25	26	27	25
33		21	24	10	27	15	4	18	6	16	5
100		0	0	0	5	0	0	0	5	0	5

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
11		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
33		1/1	1/1	0/1	1/1	1/1	0/1	1/1	0/1	1/1	0/1
100		0/1	0/1	1/1	1/1	0/1	0/1	0/1	1/1	0/1	0/1

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	02-4011-2136	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:14	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	03-5016-1143	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 12:20	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 11:40	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	33h	**Station:**			

Test Note: As per WDOE, survival data through Day 7, reproduction data through when 60%+ of the controls had 3 broods (Day 6).

Data Transform	Zeta	Alt Hyp	Trials	Seed	NOEL	LOEL	TOEL	TU
Untransformed		C > T	NA	NA	33	100	57.45	3.03

Fisher Exact/Bonferroni-Holm Test

Control	vs	C-%	Test Stat	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	1	1.0000	Exact	Non-Significant Effect
		3.3	1	1.0000	Exact	Non-Significant Effect
		11	1	1.0000	Exact	Non-Significant Effect
		33	0.04334	0.1734	Exact	Non-Significant Effect
		100	0.001548	0.0077	Exact	Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Dilution Water	10	0	10	1	0	0.0%
1		10	0	10	1	0	0.0%
3.3		10	0	10	1	0	0.0%
11		10	0	10	1	0	0.0%
33		6	4	10	0.6	0.4	40.0%
100		3	7	10	0.3	0.7	70.0%

7d Survival Rate Detail

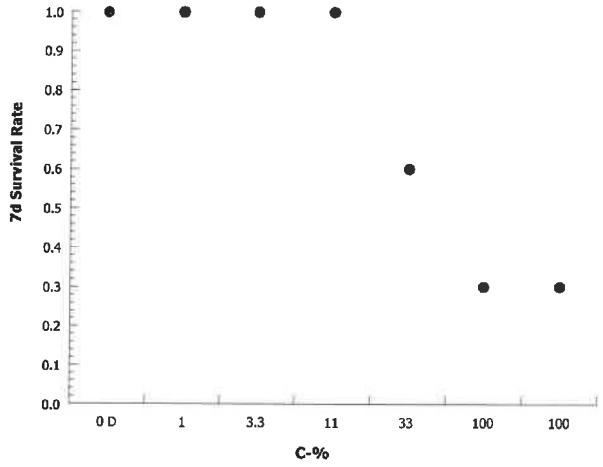
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	1	1	1
1		1	1	1	1	1	1	1	1	1	1
3.3		1	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	1	1
33		1	1	0	1	1	0	1	0	1	0
100		0	0	1	1	0	0	0	1	0	0

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
11		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
33		1/1	1/1	0/1	1/1	1/1	0/1	1/1	0/1	1/1	0/1
100		0/1	0/1	1/1	1/1	0/1	0/1	0/1	1/1	0/1	0/1

Analysis ID:	02-4011-2136	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:14	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	15-4589-1688	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:14	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	03-5016-1143	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 12:20	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 11:40	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	33h	**Station:**			

Test Note: As per WDOE, survival data through Day 7, reproduction data through when 60%+ of the controls had 3 broods (Day 6).

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C > T	NA	NA	17.5%	11	33	19.05	9.091

Steel Many-One Rank Sum Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	88	76	3	18	0.2575	Asymp	Non-Significant Effect
		3.3	117	76	3	18	0.9722	Asymp	Non-Significant Effect
		11	105.5	76	3	18	0.8122	Asymp	Non-Significant Effect
		33*	64	76	2	18	0.0036	Asymp	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1215.72	303.93	4	13.54	<0.0001	Significant Effect
Error	1010.3	22.45111	45			
Total	2226.02		49			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	14.04	13.28	0.0072	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9857	0.9367	0.8002	Normal Distribution

Reproduction Summary

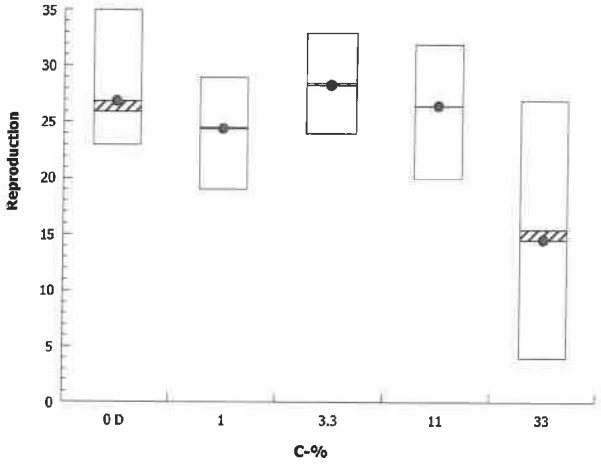
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	10	26.9	24.24	29.56	26	23	35	1.178	13.85%	0.0%
1		10	24.4	22.18	26.62	24.5	19	29	0.9798	12.7%	9.29%
3.3		10	28.3	25.89	30.71	28.5	24	33	1.065	11.9%	-5.2%
11		10	26.5	24.11	28.89	26.5	20	32	1.057	12.61%	1.49%
33		10	14.6	8.777	20.42	15.5	4	27	2.574	55.76%	45.72%

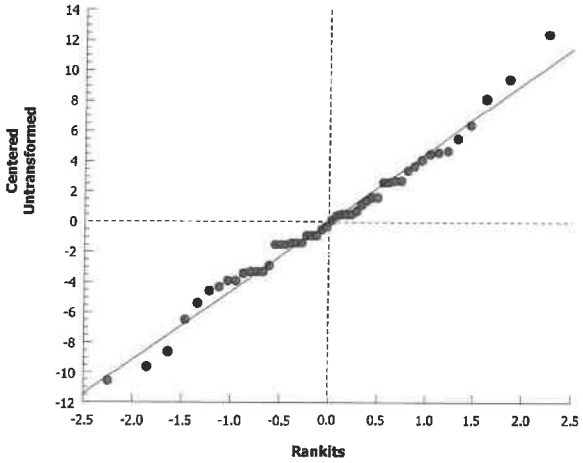
Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	24	26	28	35	27	31	26	23	23	26
1		21	23	19	23	26	23	27	29	27	26
3.3		25	24	25	31	31	28	29	33	25	32
11		20	25	31	27	27	32	25	26	27	25
33		21	24	10	27	15	4	18	6	16	5

Analysis ID:	15-4589-1688	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:14	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test

TestAmerica - ASL

Analysis ID:	04-4201-9022	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:14	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	03-5016-1143	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 12:20	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 11:40	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	33h	**Station:**			

Test Note: As per WDOE, survival data through Day 7, reproduction data through when 60%+ of the controls had 3 broods (Day 6).

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1311741	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	19.79	15.47	26.68	5.054	3.748	6.465
IC50	36.41	25.67	46.65	2.746	2.144	3.895

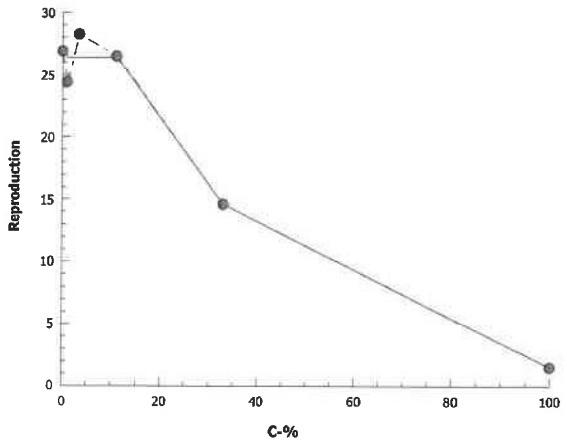
Reproduction Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	26.9	23	35	1.178	3.725	13.85%	0.0%
1		10	24.4	19	29	0.9798	3.098	12.7%	9.29%
3.3		10	28.3	24	33	1.065	3.368	11.9%	-5.2%
11		10	26.5	20	32	1.057	3.342	12.61%	1.49%
33		10	14.6	4	27	2.574	8.14	55.76%	45.72%
100		10	1.5	0	5	0.7638	2.415	161.0%	94.42%

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	24	26	28	35	27	31	26	23	23	26
1		21	23	19	23	26	23	27	29	27	26
3.3		25	24	25	31	31	28	29	33	25	32
11		20	25	31	27	27	32	25	26	27	25
33		21	24	10	27	15	4	18	6	16	5
100		0	0	0	5	0	0	0	5	0	5

Graphics



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 1 | Waterbath/incubator Used: # 7 | Date Initiated 7/26/2018 Time 15:05

Initial sample ID B 4049 - 01 | Date Terminated 8/2/2018 Time 16:20

Client: Energy Northwest | Sample Description:

Tech: Day 0 BAM/MB Day 1 EBS/LE Day 2 EBS LE Day 3 BAM Day 4 BAM Day 5 BM Day 6 BAM Day 7 BAM

Time: Day 0 1505 Day 1 1150 Day 2 1330 Day 3 1650 Day 4 1610 Day 5 1310 Day 6 1655 Day 7 1620

Conc. or Percent	Day	Number of Live Organisms				Dissolved O_2 (mg/l)		pH		Temp. (°C)	Therm. ID #	Conductivity (µS)
		A	B	C	D	Pre	Post	Pre	Post	Pre		Post (1st use)
Control	0	10	10	10	10		8.0		7.7	Post: 25.0	250	324
	1	10	10	10	10	7.4	7.4	7.2	7.4	25.0	251	316
	2	9	10	10	10	6.7	7.7	7.3	7.9	24.9	251	338
	3	9	10	10	10	6.6	7.7	7.6	7.9	25.0	250	
	4	9	10	10	10	6.4	7.6	7.2	7.7	24.9	250	
	5	9	10	9	10	6.6	7.5	7.1	7.7	24.9	250	347
	6	9	10	9	10	5.7	6.8	7.4	7.8	24.1	252	
	7	9	10	9	10	6.7		7.1		24.8	250	
1.0 %	0	10	10	10	10		8.1		7.8	Post: 25.1		323
	1	10	10	10	10	6.4	7.9	7.4	7.7	25.0		329
	2	9	10	10	10	6.4	7.9	7.5	8.0	24.9		321
	3	9	10	10	10	6.8	7.8	7.5	8.0	24.9		
	4	9	10	9	10	6.4	7.8	7.2	7.8	24.7		
	5	9	10	9	10	6.7	7.4	7.2	7.8	24.9		357
	6	9	10	9	10	5.7	7.0	7.5	7.9	24.2		
	7	9	10	9	10	6.9		7.1		24.8		
3.3 %	0	10	10	10	10		8.1		7.8	Post: 25.2		356
	1	10	10	10	10	6.6	7.7	7.5	7.7	25.1		351
	2	10	9	10	10	6.7	8.0	7.6	8.0	25.0		372
	3	10	9	10	10	6.7	7.9	7.5	8.0	24.9		
	4	10	9	9	10	6.2	7.8	7.2	7.9	24.6		
	5	10	9	9	10	6.6	7.4	7.2	7.8	24.8		367
	6	10	9	9	10	5.6	7.0	7.4	7.9	24.1		
	7	10	9	9	10	6.8		7.1		24.9		
11.0 %	0	10	10	10	10		8.1		7.8	Post: 24.8		448
	1	10	10	10	10	6.5	8.0	7.5	7.7	25.0		431
	2	10	10	10	10	6.6	7.9	7.7	8.0	24.8		439
	3	10	10	10	10	6.7	7.9	7.5	8.0	24.9		
	4	10	10	10	10	6.2	7.9	7.2	7.8	24.9		
	5	10	10	10	10	6.6	7.4	7.2	7.8	24.9		429
	6	10	10	10	10	5.6	7.0	7.4	7.9	24.2		
	7	10	10	10	10	6.7		7.1		24.8		
33.0 %	0	10	10	10	10		8.1		7.7	Post: 25.2		625
	1	10	10	10	10	6.8	8.2	7.5	7.7	25.0		639
	2	10	10	10	10	6.7	8.3	7.7	8.0	24.8		619
	3	10	10	9	10	6.7	7.9	7.4	7.9	24.8		
	4	10	10	9	10	6.2	7.9	7.2	7.8	24.8		
	5	10	10	9	10	6.4	7.6	7.2	7.8	24.8		574
	6	10	10	9	10	5.6	7.1	7.4	7.9	24.1		
	7	10	10	9	10	6.7		7.2		24.8		
100 %	0	10	10	10	10		8.2		7.7	Post: 25.1		1148
	1	10	10	10	10	6.9	7.9 after shake down	7.6	7.7	25.0		1198
	2	10	10	10	9	6.8	8.2	7.7	7.8	24.8		1120
	3	10	10	10	9	6.7	8.2	7.5	7.8	24.9		
	4	10	9	10	9	6.2	8.3	7.2	7.7	24.8		
	5	10	9	10	9	6.2	7.5	7.2	7.8	24.8		986
	6	10	9	10	9	5.6	7.1	7.4	7.9	24.1		
	7	10	9	10	9	6.6		7.4		24.8		

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.
☐ Aeration in test chambers begun @ _____ (Note observations on Test Organism Info sheet)

Pre =Pre-renewal solutions. Post =Post-renewal solutions.
Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
(23.8) = Temp. out of recommended range

To BATH 10 @ Day 5 Amt BM

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy Northwest | Tins Labeled As: ENW

Lab ID: | Start Date:

Sample Description:

Technician:		MB
Date:		8/2/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A		1089.94	9
	B		1113.30	10
	C		1085.59	9
	D		1100.77	10
1.0 %	A		1105.70	9
	B		1086.71	10
	C		1088.54	9
	D		1095.19	10
3.3 %	A		1090.74	10
	B		1079.82	9
	C		1069.79	9
	D		1088.39	10
11 %	A		1104.94	10
	B		1092.06	10
	C		1126.74	10
	D		1066.55	10
33 %	A		1114.91	10
	B		1070.33	10
	C		1079.11	9
	D		1089.08	10
100 %	A		1084.75	10
	B		1090.37	9
	C		1091.91	10
	D		1096.77	9
	A			
	B			
	C			
	D			

weigh to 0.01 mg

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy Northwest | Tins Labeled As: ENW

Lab ID: B4049 | Start Date: 7/26/2018

Sample Description:

Technician:	MB	MB
Date:	8/9/2018	8/2/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A	1099.97	1089.94	9
	B	1123.51	1113.30	10
	C	1095.87	1085.59	9
	D	1110.37	1100.77	10
1.0 %	A	1115.30	1105.70	9
	B	1096.48	1086.71	10
	C	1097.48	1088.54	9
	D	1104.65	1095.19	10
3.3 %	A	1101.77	1090.74	10
	B	1089.66	1079.82	9
	C	1078.67	1069.79	9
	D	1099.59	1088.39	10
11 %	A	1115.41	1104.94	10
	B	1101.65	1092.06	10
	C	1136.15	1126.74	10
	D	1075.89	1066.55	10
33 %	A	1124.42	1114.91	10
	B	1079.50	1070.33	10
	C	1087.72	1079.11	9
	D	1099.78	1089.08	10
100 %	A	1095.15	1084.75	10
	B	1100.63	1090.37	9
	C	1102.31	1091.91	10
	D	1106.66	1096.77	9
	A			
	B			
	C			
	D			

weigh to 0.01 mg

CETIS Summary Report

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Batch ID:	06-1927-0410	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 15:05	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 16:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	7d 1h	**Source:**	Aquatox, AR	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01 ✓	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151) ✓		
Sample Age:	36h	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
12-3767-9667	7d Survival Rate	100	>100	NA	9.42%	1	Steel Many-One Rank Sum Test
16-8141-4904	Mean Dry Biomass-mg	100	>100	NA	11.0%	1	Dunnett Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
08-0066-5278	Mean Dry Biomass-mg	IC25	>100	N/A	N/A	<1	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
12-3767-9667	7d Survival Rate	Control Resp	0.95	0.8 - NL	Yes	Passes Acceptability Criteria
08-0066-5278	Mean Dry Biomass-mg	Control Resp	1.003	0.25 - NL	Yes	Passes Acceptability Criteria
16-8141-4904	Mean Dry Biomass-mg	Control Resp	1.003	0.25 - NL	Yes	Passes Acceptability Criteria ✓
16-8141-4904	Mean Dry Biomass-mg	PMSD	0.1099	0.12 - 0.3	Yes	Below Acceptability Criteria ok

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.95	0.8581	1	0.9	1	0.02887	0.05774	6.08%	0.0%
1		4	0.95	0.8581	1	0.9	1	0.02887	0.05774	6.08%	0.0%
3.3		4	0.95	0.8581	1	0.9	1	0.02887	0.05774	6.08%	0.0%
11		4	1	1	1	1	1	0	0	0.0%	-5.26%
33		4	0.975	0.8954	1	0.9	1	0.025	0.05	5.13%	-2.63%
100		4	0.95	0.8581	1	0.9	1	0.02887	0.05774	6.08%	0.0%

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1.003	0.9544	1.052	0.96	1.028	0.01527	0.03054	3.05%	0.0%
1		4	0.9443	0.8873	1.001	0.894	0.977	0.01791	0.03582	3.79%	5.86%
3.3		4	1.024	0.8505	1.197	0.888	1.12	0.05443	0.1089	10.63%	-2.07%
11		4	0.9703	0.8871	1.053	0.934	1.047	0.02612	0.05224	5.39%	3.27%
33		4	0.9498	0.8092	1.09	0.861	1.07	0.04417	0.08834	9.3%	5.31%
100		4	1.024	0.9854	1.062	0.989	1.04	0.01204	0.02409	2.35%	-2.07%

Fathead Minnow 7-d Larval Survival and Growth Test

TestAmerica - ASL

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.9	1	0.9	1
1		0.9	1	0.9	1
3.3		1	0.9	0.9	1
11		1	1	1	1
33		1	1	0.9	1
100		1	0.9	1	0.9

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.003	1.021	1.028	0.96
1		0.96	0.977	0.894	0.946
3.3		1.103	0.984	0.888	1.12
11		1.047	0.959	0.941	0.934
33		0.951	0.917	0.861	1.07
100		1.04	1.026	1.04	0.989

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	9/10	10/10	9/10	10/10
1		9/10	10/10	9/10	10/10
3.3		10/10	9/10	9/10	10/10
11		10/10	10/10	10/10	10/10
33		10/10	10/10	9/10	10/10
100		10/10	9/10	10/10	9/10

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	12-3767-9667	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:16	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-1927-0410	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 15:05	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 16:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	7d 1h	**Source:**	Aquatox, AR	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	36h	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Angular (Corrected)	NA	C > T	NA	NA	9.42%	100	>100	NA	1

Steel Many-One Rank Sum Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	18	10	3	6	0.8333	Asymp	Non-Significant Effect
		3.3	18	10	3	6	0.8333	Asymp	Non-Significant Effect
		11	22	10	2	6	0.9908	Asymp	Non-Significant Effect
		33	20	10	3	6	0.9516	Asymp	Non-Significant Effect
		100	18	10	3	6	0.8333	Asymp	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02323942	0.004647883	5	0.6632	0.6560	Non-Significant Effect
Error	0.1261568	0.007008713	18			
Total	0.1493962		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	4.2	4.248	0.0105	Equal Variances
Variances	Levene Equality of Variance	15.4	4.248	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8224	0.884	0.0007	Non-normal Distribution

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	0.95	0.8581	1	0.95	0.9	1	0.02887	6.08%	0.0%
1		4	0.95	0.8581	1	0.95	0.9	1	0.02887	6.08%	0.0%
3.3		4	0.95	0.8581	1	0.95	0.9	1	0.02887	6.08%	0.0%
11		4	1	1	1	1	1	1	0	0.0%	-5.26%
33		4	0.975	0.8954	1	1	0.9	1	0.025	5.13%	-2.63%
100		4	0.95	0.8581	1	0.95	0.9	1	0.02887	6.08%	0.0%

Angular (Corrected) Transformed Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	0.0%
1		4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	0.0%
3.3		4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	0.0%
11		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.0%	-6.12%
33		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	-3.06%
100		4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	0.0%

Fathead Minnow 7-d Larval Survival and Growth Test **TestAmerica - ASL**

Analysis ID:	12-3767-9667	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:16	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.9	1	0.9	1
1		0.9	1	0.9	1
3.3		1	0.9	0.9	1
11		1	1	1	1
33		1	1	0.9	1
100		1	0.9	1	0.9

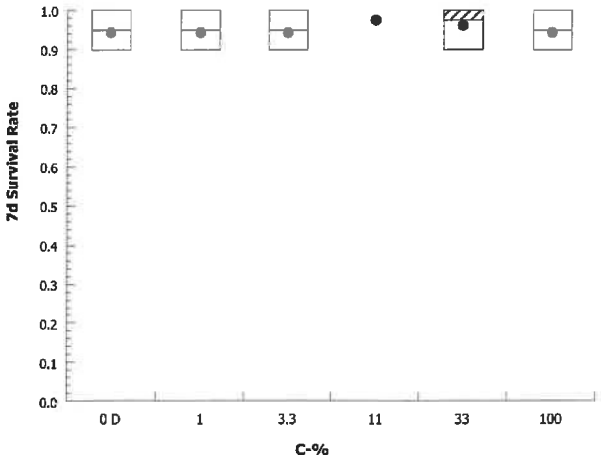
Angular (Corrected) Transformed Detail

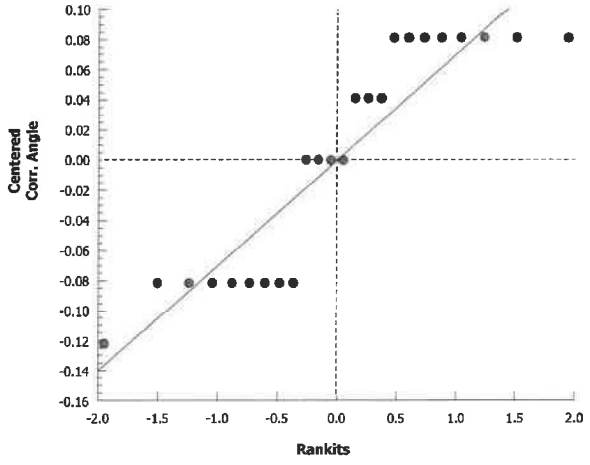
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.249	1.412	1.249	1.412
1		1.249	1.412	1.249	1.412
3.3		1.412	1.249	1.249	1.412
11		1.412	1.412	1.412	1.412
33		1.412	1.412	1.249	1.412
100		1.412	1.249	1.412	1.249

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	9/10	10/10	9/10	10/10
1		9/10	10/10	9/10	10/10
3.3		10/10	9/10	9/10	10/10
11		10/10	10/10	10/10	10/10
33		10/10	10/10	9/10	10/10
100		10/10	9/10	10/10	9/10

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	16-8141-4904	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:16	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes
Batch ID:	06-1927-0410	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 15:05	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 16:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	7d 1h	**Source:**	Aquatox, AR	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	36h	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C > T	NA	NA	11.0%	100	>100	NA	1

Dunnett Multiple Comparison Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	1.282	2.407	0.110	6	0.3047	CDF	Non-Significant Effect
		3.3	-0.453	2.407	0.110	6	0.9328	CDF	Non-Significant Effect
		11	0.7149	2.407	0.110	6	0.5512	CDF	Non-Significant Effect
		33	1.162	2.407	0.110	6	0.3524	CDF	Non-Significant Effect
		100	-0.453	2.407	0.110	6	0.9328	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02577513	0.005155027	5	1.228	0.3364	Non-Significant Effect
Error	0.07554106	0.004196725	18			
Total	0.1013162		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	9.134	15.09	0.1039	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9649	0.884	0.5442	Normal Distribution

Mean Dry Biomass-mg Summary

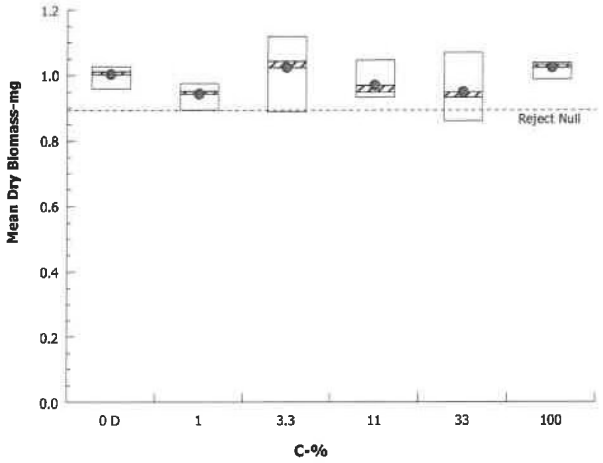
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	1.003	0.9544	1.052	1.012	0.96	1.028	0.01527	3.05%	0.0%
1		4	0.9443	0.8873	1.001	0.953	0.894	0.977	0.01791	3.79%	5.86%
3.3		4	1.024	0.8505	1.197	1.044	0.888	1.12	0.05443	10.63%	-2.07%
11		4	0.9703	0.8871	1.053	0.95	0.934	1.047	0.02612	5.39%	3.27%
33		4	0.9498	0.8092	1.09	0.934	0.861	1.07	0.04417	9.3%	5.31%
100		4	1.024	0.9854	1.062	1.033	0.989	1.04	0.01204	2.35%	-2.07%

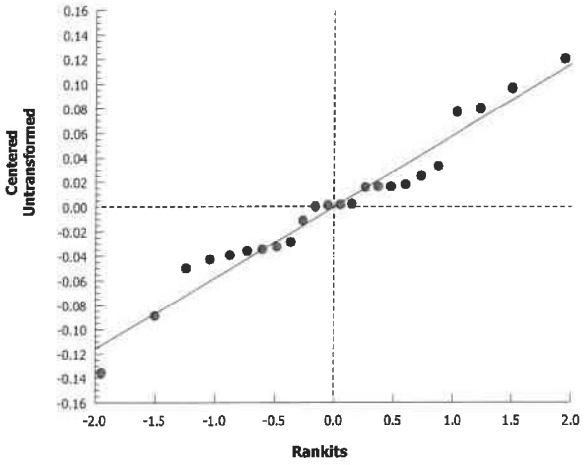
Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.003	1.021	1.028	0.96
1		0.96	0.977	0.894	0.946
3.3		1.103	0.984	0.888	1.12
11		1.047	0.959	0.941	0.934
33		0.951	0.917	0.861	1.07
100		1.04	1.026	1.04	0.989

Analysis ID:	16-8141-4904	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:16	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	08-0066-5278	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	17 Aug-18 11:16	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	06-1927-0410	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Brett Muckey
Start Date:	26 Jul-18 15:05	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	02 Aug-18 16:20	**Species:**	Pimephales promelas	**Brine:**	
Duration:	7d 1h	**Source:**	Aquatox, AR	**Age:**	
Sample ID:	13-9857-8979	**Code:**	B4049-01	**Client:**	
Sample Date:	25 Jul-18 03:18	**Material:**	POTW Effluent	**Project:**	
Receive Date:	26 Jul-18 10:55	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	36h	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	751184	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	N/A	N/A	<1	NA	NA

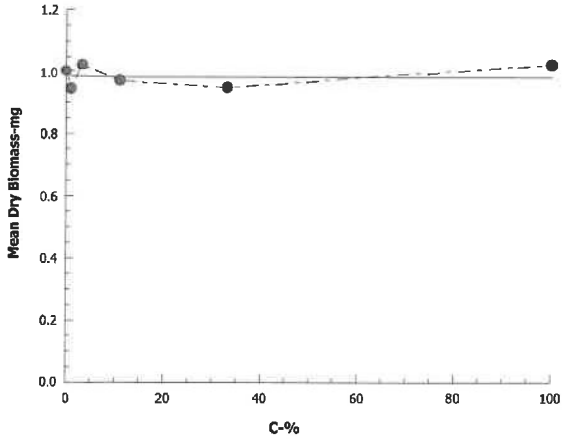
Mean Dry Biomass-mg Summary

			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1.003	0.96	1.028	0.01527	0.03054	3.05%	0.0%
1		4	0.9443	0.894	0.977	0.01791	0.03582	3.79%	5.86%
3.3		4	1.024	0.888	1.12	0.05443	0.1089	10.63%	-2.07%
11		4	0.9703	0.934	1.047	0.02612	0.05224	5.39%	3.27%
33		4	0.9498	0.861	1.07	0.04417	0.08834	9.3%	5.31%
100		4	1.024	0.989	1.04	0.01204	0.02409	2.35%	-2.07%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.003	1.021	1.028	0.96
1		0.96	0.977	0.894	0.946
3.3		1.103	0.984	0.888	1.12
11		1.047	0.959	0.941	0.934
33		0.951	0.917	0.861	1.07
100		1.04	1.026	1.04	0.989

Graphics



APPENDIX B

REFERENCE TOXICANT DATA SHEETS

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: QA / QC Test Start Date: 7-10-18

Sample Description: NaCl Initial Sample ID#: 2B0628-06

Data summarized by: MB

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	10 AD?	30 AD?	23 AD?	31 AD?	26 AD?	27 AD?	29 AD?	0 AD? ✓	27 AD?	22 AD?	9	225
0.25 g/L	10 AD?	14 AD?	14 AD?	28 AD?	26 AD?	31 AD?	25 AD?	29 AD?	27 AD?	11 AD?	10	215
0.50 g/L	11 AD?	25 AD?	24 AD?	25 AD?	14 AD?	28 AD?	24 AD?	29 AD?	26 AD?	4 AD?	10	210
1.0 g/L	14 AD?	7 AD?	20 AD?	10 AD?	9 AD?	18 AD?	21 AD?	25 AD?	19 AD?	0 AD? ✓	9	143
1.5 g/L	0 AD?	6 AD?	2 AD?	2 AD? ✓	0 AD? ✓	8 AD?	9 AD?	8 AD?	11 AD?	0 AD?	8	46
2.0 g/L	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0	0
4.0 g/L	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0	0

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

Endpoint	IC25	Cusum Chart Limits
Survival	1.54	1.15 to 2.17
Reproduction	0.79	0.17 to 1.25

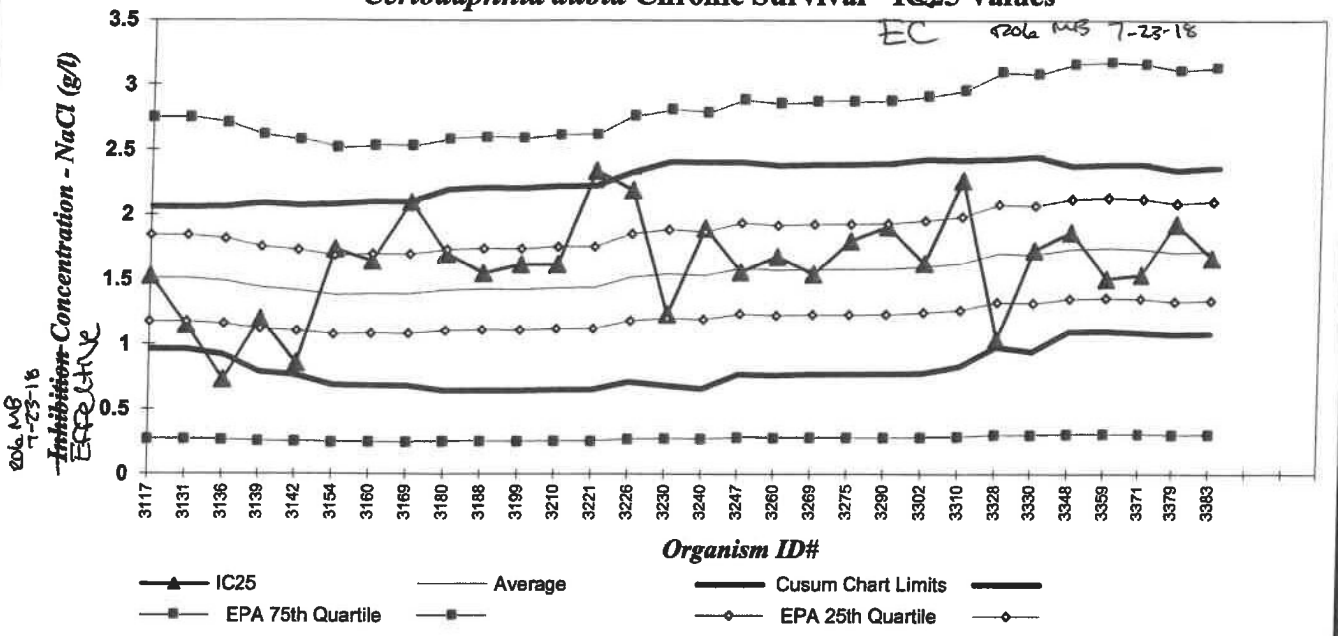
Task Manager

Project Manager

QA Officer 7/23/2018

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART

Ceriodaphnia dubia Chronic Survival - ~~IC25~~ EC Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.07

25th Quartile CV (*warning limit*) = 0.11

75th Quartile CV (warning *limit*) = 0.41

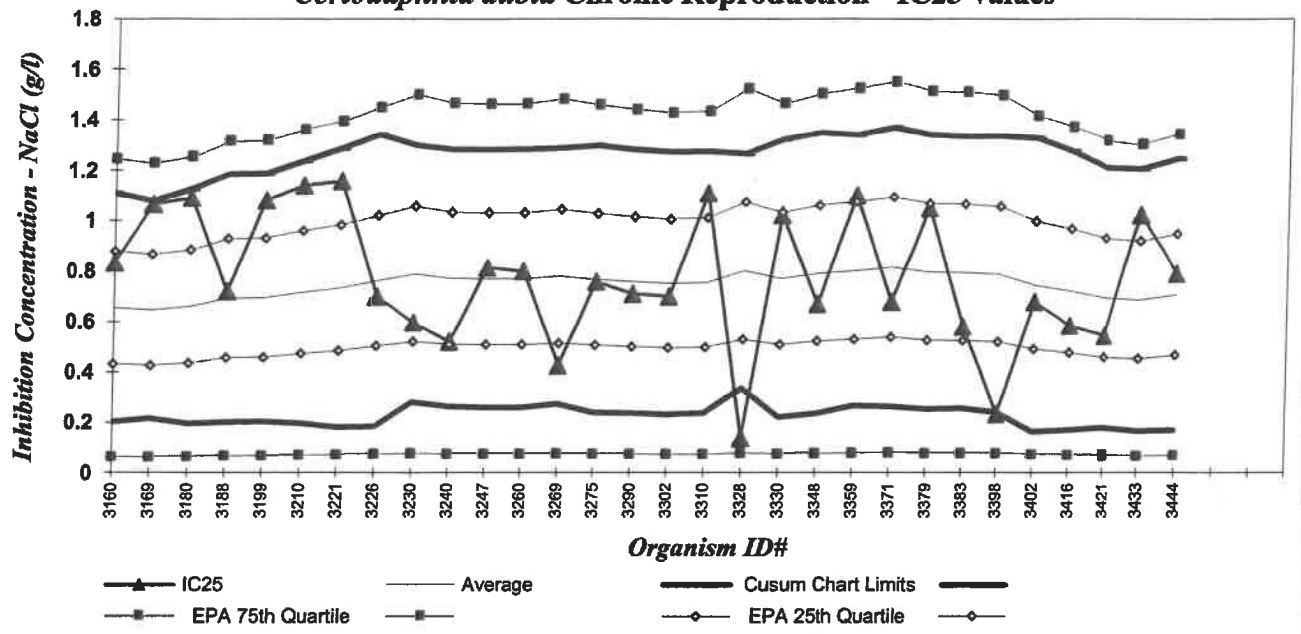
90th Quartile CV (*control limit*) = 0.81

*Intralab CV is compared to EPA **Warning limits** (25th and 75th CV's) and **Control limits** (10th and 90th CV's).*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	Cerio ID #	Test Start Date	~~IC25~~ EC	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
316	3328	07/20/17	1.04	1.70	0.36	**0.98**	**2.43**	0.22
317	3330	08/01/17	1.73	1.70	0.37	**0.95**	**2.45**	0.18
318	3348	09/07/17	1.87	1.74	0.32	**1.10**	**2.38**	0.18
319	3359	10/03/17	1.51	1.75	0.32	**1.11**	**2.39**	0.19
320	3371	11/07/17	1.54	1.74	0.32	**1.09**	**2.39**	0.18
321	3379	12/12/17	1.93	1.71	0.32	**1.08**	**2.34**	0.19
322	3383	01/09/18	1.67	1.72	0.32	**1.08**	**2.36**	0.18
323	3398	02/06/18	1.36	1.73	0.32	**1.10**	**2.36**	0.19
324	3402	02/27/18	1.68	1.72	0.33	**1.06**	**2.37**	0.19
325	3416	04/10/18	1.62	1.72	0.33	**1.07**	**2.37**	0.17
326	3421	05/01/18	1.41	1.68	0.29	**1.10**	**2.27**	0.17
327	3433	06/05/18	1.52	1.64	0.27	**1.10**	**2.19**	0.15
328	3444	07/10/18	1.54	1.66	0.26	**1.15**	**2.17**	0.15
329								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART
Ceriodaphnia dubia Chronic Reproduction - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Reproduction

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.08

25th Quartile CV (*warning limit*) = 0.17

75th Quartile CV (warning *limit*) = 0.45

90th Quartile CV (*control limit*) = 0.62

*Intralab CV is compared to EPA **Warning limits** (25th and 75th CV's) and **Control limits** (10th and 90th CV's).*
If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
318	3348	9/7/2017	0.67	0.79	0.28	**0.24**	**1.35**	0.33
319	3359	10/3/2017	1.10	0.80	0.27	**0.27**	**1.34**	0.34
320	3371	11/7/2017	0.68	0.82	0.28	**0.26**	**1.37**	0.34
321	3379	12/12/2017	1.05	0.80	0.27	**0.25**	**1.34**	0.34
322	3383	1/9/2018	0.58	0.79	0.27	**0.26**	**1.33**	0.35
323	3398	2/6/2018	0.23	0.79	0.27	**0.24**	**1.33**	0.39
324	3402	2/27/2018	0.68	0.75	0.29	**0.16**	**1.33**	0.38
325	3416	4/10/2018	0.58	0.72	0.28	**0.17**	**1.27**	0.37
326	3421	5/1/2018	0.54	0.69	0.26	**0.18**	**1.21**	0.38
327	3433	6/5/2018	1.02	0.69	0.26	**0.17**	**1.21**	0.38
328	3444	7/10/2018	0.79	0.71	0.27	**0.17**	**1.25**	0.37
329								
330								
331								

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 8
Stock Sol. ID 2B068 -02
Organism ID: FHM 1993

Waterbath/incubator Used: # 4

Date Initiated 7/10/2018 Time 16:30
Date Terminated 7/17/2018 Time 09:15

Test Container Size: 800 ml Solution Volume / rep: 500 ml

Client QA / QC - RefTox Sample Description KCl (50 g/L stock)

Tech: Day 0 MB/LC Day 1 BAM Day 2 LC Day 3 LC Day 4 BAM/LC Day 5 BAM Day 6 BAM Day 7 MB
Time Day 0 1630 Day 1 1420 Day 2 1520 Day 3 1115 Day 4 1405 Day 5 1820 Day 6 1405 Day 7 0915

Conc. or Percent	Day	Number of Live Organisms A	B	C	D	Dissolved O_2 (mg/l) Pre	Post	pH Pre	Post	Temp. (°C) Pre	Therm. ID #	Conductivity (µS) Post (daily)
Control	0	10	10	10	10		8.0		7.7	Post: 24.6	252	308
	1	10	10	10	10	7.1	8.3	7.2	7.8	25.0	252	302
	2	10	10	10	10	7.7	7.6	7.5	7.8	24.7	252	308
	3	10	10	10	9	6.6	7.7	7.4	7.8	24.7	252	335
	4	10	10	10	9	6.6	7.9	7.0	7.6	24.7	252	318
	5	10	10	10	9	6.6	7.8	7.1	7.7	24.9	252	388
	6	10	10	10	9	6.6	7.9	7.0	7.5	24.7	252	*
	7	10	10	10	9	6.6		7.1		24.9	252	
0.25 g/L	0	10	10	10	10		8.1		7.8	Post: 24.7		794
	1	10	9	10	10	7.2	8.3	7.2	7.9	25.0		784
	2	10	9	10	10	7.4	7.8	7.5	7.8	24.7		744
	3	10	9	10	10	6.7	7.9	7.4	7.8	24.6		757
	4	10	9	10	10	6.5	7.9	6.9	7.8	24.7		776
	5	10	9	10	10	6.6	7.9	7.2	7.8	24.9		755
	6	10	9	10	10	6.5	7.9	7.0	7.6	24.8		*
	7	10	9	10	10	6.7		7.0		24.9		
0.50 g/L	0	10	10	10	10		8.1		7.8	Post: 24.9		1218
	1	10	10	10	10	7.3	7.9	7.2	7.9	25.0		1220
	2	9	10	9	10 (10 + 9 = 10)	7.2	7.9	7.5	7.8	24.7		1182
	3	9	10	9	10	6.7	7.9	7.4	7.9	24.6		1205
	4	9	10	8	10	6.5	8.0	7.2	7.8	24.6		1202
	5	9	10	8	10	6.3	8.0	7.2	7.9	24.8		1276
	6	9	10	8	10	6.4	8.1	7.1	7.7	24.7		*
	7	9	10	8	10	6.9		7.1		24.9		
1.0 g/L	0	10	10	10	10		8.1		7.9	Post: 25.0		2030
	1	2	3	4	1	7.3	8.3	7.2	7.9	25.0		2030
	2	2	3	4	1	7.1	8.0	7.5	7.8	24.6		2030
	3	1	2	3	1	6.7	7.9	7.4	7.9	24.6		2030
	4	0	1	3	1	6.5	8.1	7.3	7.9	24.7		2040
	5	1	1	3	1	6.4	8.1	7.4	7.9	24.9		2010
	6	1	1	3	0	6.5	8.3	7.2	7.9	24.7		*
	7	1	1	3	—	6.9		7.1		24.9		
2.0 g/L	0	10	10	10	10		8.0		7.9	Post: 25.1		3610
	1	0	0	0	0	7.4		7.2		24.9		
	2											
	3											
	4											
	5											
	6											
	7											
4.0 g/L	0	10	10	10	10		8.0		7.8	Post: 25.1		6790
	1	0	0	0	0	7.2		7.3		25.0		
	2											
	3											
	4											
	5											
	6											
	7											

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.

Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
Pre =Pre-renewal solutions. Post =Post-renewal solutions.
23.8 = Temp. out of recommended range

Endpoint	EC25 / IC25	Cusum Chart Limits
Survival	0.61	0.57 to 0.64
Growth	0.53	0.44 to 0.73

Task Manager
Project Manager
QA Officer Kathy Mowery 7/23/2018

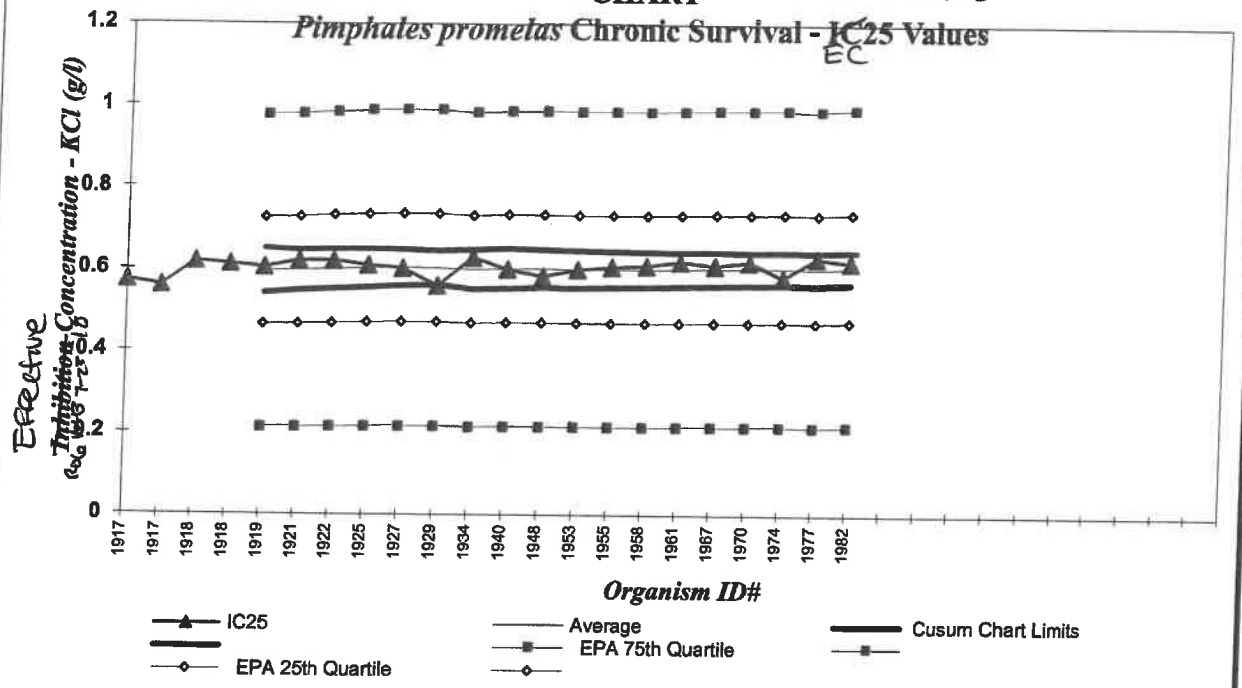
* Conductivity measurements were missed (discovered 7-17-18) by analyst on 7-16-18 BAM 7-17-18

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART

RoL MS 7-23-18

Pimphales promelas Chronic Survival - IC25 Values

EC



***Pimephales promelas* - Chronic (EPA Test Method 1000.0)**

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.03

25th Quartile CV (*warning limit*) = 0.11

75th Quartile CV (*warning limit*) = 0.32

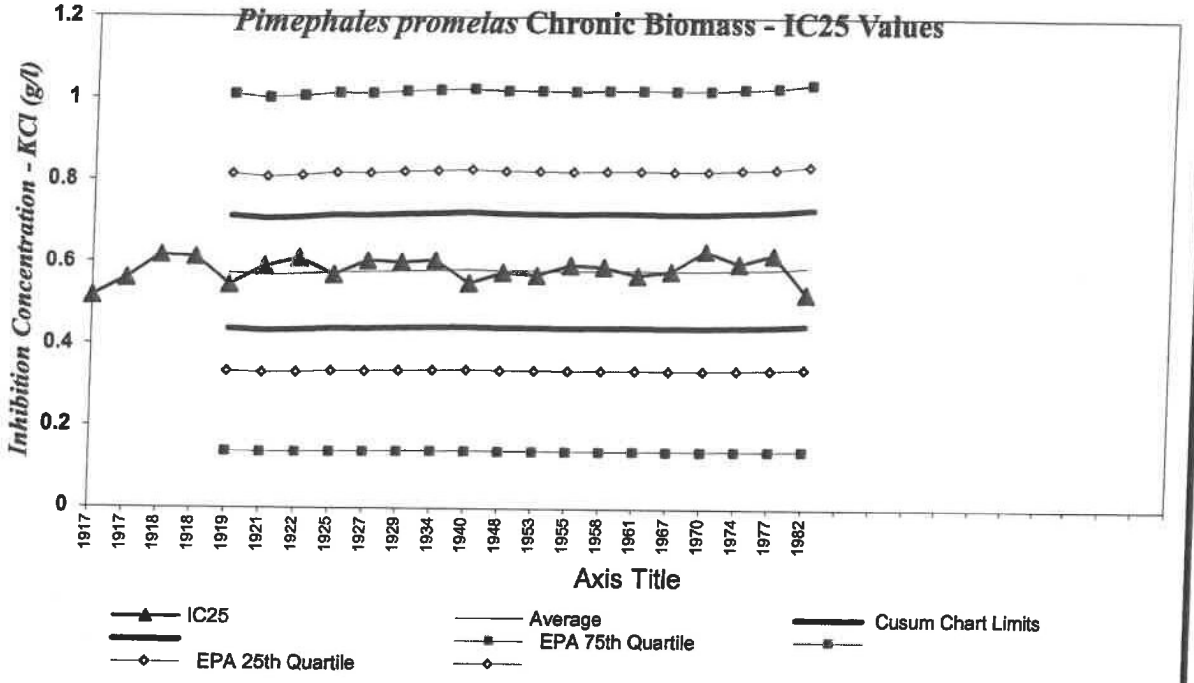
90th Quartile CV (*control limit*) = 0.52

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's).*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	FHM ID #	Test Start Date	RoL MS 7-23-18 IC25 7-23-18 EC	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
13	1940	08/01/17	**0.60**	0.6	0.02	**0.55**	**0.65**	0.04
14	1948	09/12/17	**0.58**	0.6	0.02	**0.56**	**0.65**	0.04
15	1953	10/10/17	**0.60**	0.6	0.02	**0.56**	**0.65**	0.04
16	1955	11/07/17	**0.61**	0.6	0.02	**0.56**	**0.64**	0.04
17	1958	12/12/17	**0.61**	0.6	0.02	**0.56**	**0.64**	0.04
18	1961	01/17/18	**0.62**	0.6	0.02	**0.56**	**0.64**	0.03
19	1967	02/06/18	**0.61**	0.6	0.02	**0.56**	**0.64**	0.03
20	1970	02/27/18	**0.62**	0.6	0.02	**0.56**	**0.64**	0.03
21	1974	03/20/18	**0.58**	0.6	0.02	**0.56**	**0.64**	0.03
22	1977	04/03/18	**0.63**	0.6	0.02	**0.56**	**0.64**	0.03
23	1982	05/02/18	**0.62**	0.6	0.02	**0.57**	**0.64**	0.03
24	1984	06/19/18	**0.63**	0.6	0.02	**0.57**	**0.64**	0.03
25	1993	07/10/18	**0.61**	0.6	0.02	**0.57**	**0.64**	0.03
26								
27								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



Pimephales promelas - Chronic (EPA Test Method 1000.0)

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Growth (Biomass)

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) =	0.12
25th Quartile CV (*warning limit*) =	0.21
75th Quartile CV (*warning limit*) =	0.38
90th Quartile CV (*control limit*) =	0.45

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's). If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	FHM ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
13	1940	8/1/2017	**0.55**	0.58	0.03	**0.44**	**0.72**	0.05
14	1948	9/12/2017	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
15	1953	10/10/2017	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
16	1955	11/7/2017	**0.59**	0.58	0.03	**0.44**	**0.72**	0.05
17	1958	12/12/17	**0.59**	0.58	0.03	**0.44**	**0.72**	0.05
18	1961	01/17/18	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
19	1967	02/06/18	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
20	1970	02/27/18	**0.63**	0.58	0.03	**0.44**	**0.72**	0.05
21	1974	03/20/18	**0.60**	0.58	0.03	**0.44**	**0.72**	0.05
22	1977	04/03/18	**0.62**	0.58	0.03	**0.44**	**0.72**	0.04
23	1982	05/02/18	**0.53**	0.59	0.02	**0.45**	**0.73**	0.05
24	1984	06/19/18	**0.57**	0.59	0.03	**0.45**	**0.73**	0.05
25	1993	07/10/18	**0.53**	0.59	0.03	**0.44**	**0.73**	0.05
26								

APPENDIX C

CHAIN OF CUSTODY

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: 84049-01 Date Received: 7-26-18

Client/Project: Energy MW Received By: BW

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 10/21/18	observed 3.2 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	adj 4.5°C	☒ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)		☒ Yes	☐ No	☐ N/A
Were the sample containers in good condition (not broken or leaking)?		☒ Yes	☐ No	☐ N/A
Are all samples within 36 hours of collection?		☒ Yes	☐ No	☐ N/A

Method of Shipment: ☐ Hand Delivered, ☒ FedEx, ☐ UPS, ☐ Greyhound, ☐ Other: _____ ☐ N/A

BW 7/26/18

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352
Contact Person: Jane LePage
Phone: 509.377.4061
Project #: Contract 344765

NPDES#: WA 0025315-1
Composite Sample Information:
Samples/Hour:
Total Hours:
Initiated: Date: Time:
Ended: Date: 072518 Time: 0318
Chilled During Collection: Y

Volume/Sample: 20L
Total Volume: 20L Grab

Ship Samples to:
PO#:

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
190086-01	072518	0318		X	1	84049.01	X	X		X														

Sampled By & Title: Matt Turner Chemistry, 072518 0318 (Please sign and print name)	Date/Time: 072518 / 0318	Relinquished By: Matt Turner (Please sign and print name)	Date/Time: 072518 / 0428
Received By: (Please sign and print name) Jane LePage	Date/Time: 072518 / 0428	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name) TA ASL	Date/Time 7/26/18 1055	Shipped Via: UPS Bis Fed-Ex Hand Other	Shipping #
Work Authorized By (Please sign and print name)	Remarks: Sample delivered to shipping dept Jan 18 1300 072518		

COC_Bioassay.xls
Doc Control ID: ASL612-0717

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B404P-02 Date Received: 7-28-18

Client/Project: Energy NW Received By:

Were custody seals intact?			☒ Yes	☐ No ☐ N/A
Packing Material:			☒ Ice	☐ Blue Ice ☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 10-21-18	cbs 3.3 act 3.2	°C	☒ Yes	☐ No ☐ N/A
Was a Chain of Custody (CoC) Provided?			☒ Yes	☐ No ☐ N/A
Was the CoC correctly filled out (If No, document below)			☒ Yes	☐ No ☐ N/A
Were the sample containers in good condition (not broken or leaking)?			☒ Yes	☐ No ☐ N/A
Are all samples within 36 hours of collection?			☒ Yes	☐ No ☐ N/A

Method of Shipment: ☐ Hand Delivered, ☐ FedEx, ☒ UPS, ☐ Greyhound, ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352

Contact Person: Jane LePage
Phone: 509.377.4061

Project #: Contract 344765

NPDES#: WA 002515-1
Composite Sample Information:

Samples/Hour: _____ Volume/Sample: _____
Total Hours: _____ Total Volume: _____
Initiated: Date _____ Time _____
Ended: Date 7/27/18 Time _____
Chilled During Collection: Y

Ship Samples to:
PO#:

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N): _____
Temp. Upon Arrival (°C): _____
Check Ammonia (Y/N): _____ Dechlorinated (Y/N): _____

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
190086-02	7/27/18	0335		✓	1	B40K9.2		X		X														2nd Sample for Renewal

Sampled By & Title (Please sign and print name): Jenn Miller	Date/Time: 072718 0335	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name): Jane LePage	Date/Time: 072718 0425	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name): TA-ASL	Date/Time: 7-28-18 1120	Relinquished By (Please sign and print name):	Date/Time:
Received By (Please sign and print name):	Date/Time:	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #: 1Z69V4044454729486
Work Authorized By (Please sign and print name):	Remarks: UPS store for Saturday delivery		

AARON HILL
(509) 377-4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

80 LBS

AH

SHIP TO:

BRETT MUCKEY
(541) 243-6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330-4741

H

OR 973 1-01

UPS NEXT DAY AIR

1S

TRACKING #: 1Z 69V 404 44 5472 9486

BILLING: P/P

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

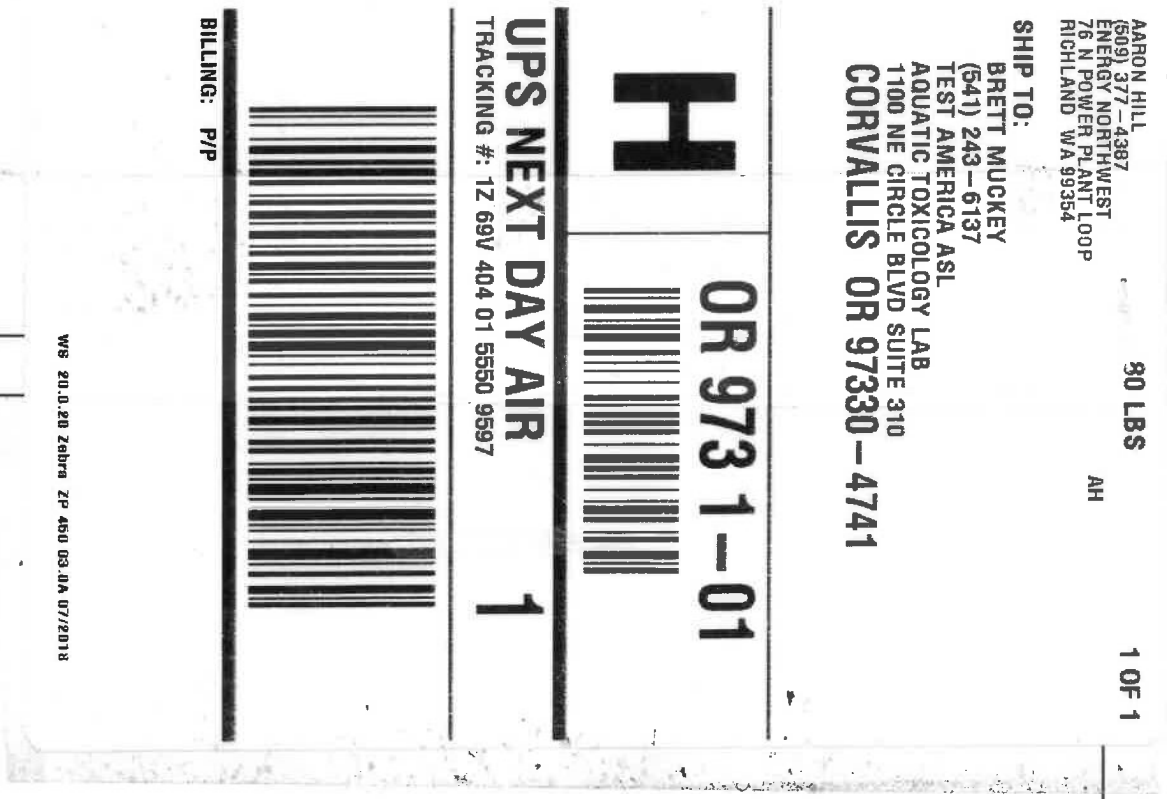
Batch Number: B4049 -03 Date Received: 7-31-18

Client/Project: ENW Received By: BAM

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6C) Therm ID: TH173 Exp. 10/21/18	2.2 °C	☒ Yes	☐ No	☐ N/A
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	

Method of Shipment: ☐ Hand Delivered, ☐ FedEx, ☒ UPS, ☐ Greyhound, ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)



Client was notified on:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968, Richland WA 99352
Contact Person: Jane LePage
Phone: 509.377.4061
Project #: Contract 344765

NPDES#: WA002515-1
Composite Sample Information:
Samples/Hour: ____ Volume/Sample: 20L
Total Hours: ____ Total Volume: 20L
Initiated: Date: ____ Time: ____
Ended: Date: 073018 Time: 1345
Chilled During Collection: Y

Ship Samples to:
PO#:

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N): ____
Temp. Upon Arrival (°C): ____
Check Ammonia (Y/N): ____ Dechlorinated (Y/N): ____

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Analysis Required / Comments: Concentration and/or Comments
190086.03	073018	1345		X	1			X		X														3rd Sample for Renewal

Sampled By & Title: JL2 Jane LePage Env. Scientist	(Please sign and print name)	Date/Time: 073018/1345	Relinquished By	(Please sign and print name) / Date/Time
Received By	(Please sign and print name)	Date/Time	Relinquished By	(Please sign and print name) / Date/Time
Received By	(Please sign and print name)	Date/Time	Relinquished By	(Please sign and print name) / Date/Time
Received By: B. Marthaller TA 182	(Please sign and print name)	Date/Time: 7-31-18 1030	Shipped Via: (UPS) Bis Fed-Ex Hand Other	Shipping #: 1Z69V4040155509597
Work Authorized By	(Please sign and print name)	Remarks: TH173 obs: 2.3°C corr: 2.2°C		COC_Bioassay.xls Doc Control ID: ASL612-0717

BIOASSAY REPORT

CHRONIC
BIOASSAYS CONDUCTED
November 6 through 13, 2018

Prepared for

ENERGY NORTHWEST
RICHLAND, WASHINGTON

Prepared by

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
ASL

1100 NE Circle Boulevard, Suite 310
Corvallis, Oregon 97330
541-207-0995

NELAC #OR100022
State of Washington Department of Ecology (WDOE), Lab ID C1233
California State Environmental Laboratory Accreditation Program, Certificate No.: 1726

Revised Report Date: December 4, 2018
Original Report Date: November 30, 2018
Lab I.D. No. B4141-chr

CONTENTS

INTRODUCTION

TestAmerica ASL (TA-ASL) – Bioassay Laboratory conducted chronic bioassays using the *Pimephales promelas* (fathead minnow) and the water flea (*Ceriodaphnia dubia*), on samples provided by Energy Northwest, Richland, Washington. The tests were conducted from November 6 through 13, 2018.

Also note that acute testing using the *Ceriodaphnia dubia* (water flea) was also initiated at this time. As per client request, the acute results will be reported separately.

Revision 1 of this report was issued to address typos in the Sample Collection and Storage section of the original report.

OVERVIEW OF REGULATORY GUIDANCE

The following provides an overview and excerpts of applicable permit specifics, regulatory guidance, and other relevant information. This is intended only as a helpful guide, from a laboratory perspective, for understanding test outcomes. The final responsibility for interpretation of results remains with the client and/or regulatory agency.

The following guidance is taken from TA-ASL's reading of the NPDES permit for Energy Northwest's Columbia Generating Station in Richland, WA (permit #WA002515-1, effective Nov 1, 2014, expires Oct 31, 2019, modified Feb 8, 2016).

Chronic toxicity:

Testing:

- "Conduct chronic toxicity testing … once per quarter in the year prior to submission of the application for permit renewal."
- "Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 11% effluent. The series of dilutions should also contain the CCEC of 1% effluent."
- "The CCEC equals 1% effluent."

Sampling and Reporting Requirements:

- "The permittee must collect grab samples … must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion."
- "The lab must begin the toxicity testing … no later than 36 hours after sampling was completed."

- "The Permittee must chemically dechlorinate final effluent … with sodium thiosulfate just prior to test initiation. Do not add more sodium thiosulfate than is necessary to neutralize the chlorine. Provide in the test report the calculations to determine the amount of sodium thiosulfate necessary …"

The following is taken from the WDOE guidance (WQ-R-95-80, June 2016 revision):

"To reduce WET limit violations (and anomalous concentration-response relationships) due to statistical significance that is a Type I error [false positive], we lower alpha when differences in test organism response are small."

"Alpha will be lowered from 0.05 to 0.01 if a … 20% difference in a chronic test is significant."

SUMMARY OF TEST RESULTS

Exhibit 1 provides a summary of the final test results.

EXHIBIT 1
Summary of Chronic Test Results

Species	NOEC (%)	LOEC (%)	IC_{25} (%)
C. dubia	33	100	38.7
P. promelas	100	> 100	> 100

Note: acronyms are as defined below.

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

More detailed information is provided in the Results and Discussion section.

ACRONYM DEFINITIONS (from EPA guidance):

NOEC = No Observed Effect Concentration: The highest test concentration that causes no observable adverse effects on the test organisms (i.e. no statistically significant reduction from the control).
LOEC = Low Observed Effect Concentration: The lowest test concentration that does cause an observable adverse effect on the test organisms (i.e. is statistically significant reduction from the control).
IC_{25} = Inhibition Concentration (25%): A point estimate of the test concentration that would cause a 25 percent reduction of a non-quantal biological measurement (i.e. growth, reproduction, etc.) for the test population.

SAMPLE INFORMATION

Exhibit 2 provides a summary of the sample conditions as received.

EXHIBIT 2
Sample Conditions on Receipt

Sample ID	**190440**		
TA-ASL SDG + suffix	B4141 -01	-02	-03
Collection - Date and Time	11/05/2018 05:30	11/07/2018 05:25	11/09/2018 05:25
Receipt - Date and Time	11/06/2018 10:00	11/09/2018 10:50	11/10/2018 11:00
Temperature (^{o}C)	4.5	1.7	1.6
Dissolved Oxygen (mg/L)	8.2	8.8	8.9
pH	7.7	8.2	7.9
Conductivity (S/cm)	1105	971	846
Total Residual Chlorine (mg/L)	0.03	0.04	0.05
Ammonia (mg/L as NH_3-N)	< 0.10	< 0.10	< 0.10
Total Hardness (mg/L as $CaCO_3$)	667	635	505
Total Alkalinity (mg/L as $CaCO_3$)	107	108	105

Water quality measurements during testing remained within test design limits as prescribed by EPA and WDOE, except as noted with the individual test results. (see the Results and Discussion section)

METHODS AND MATERIALS

TEST METHODS

The chronic test methods were performed according to: *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition, (2002), EPA-821-R-02-013.

Additional guidance was provided by:

Whole Effluent Toxicity Testing Guidance and Test Review Criteria, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

DEVIATIONS FROM PROTOCOLS

Deviations from required procedures in the test methods:

None noted.

Deviations from recommended procedures in the test methods:

The sample collected on Wednesday, November 7, 2018 was not successfully delivered as scheduled on Thursday. The sample was received in good condition and used for test solution renewals on Friday, November 9, 2018. As a result, the chronic test renewals performed on November 9, 2018 were outside of the EPA recommended holding time of 36 hours for initial use of a sample. See further discussion in the Sample Collection and Storage section.

TEST DESIGN

The following summarizes the conditions used for both overall testing and the specifics for each test (observations and notations can be found on the datasheets in Appendix A):

Overall Test Design:

Chronic tests: 1.0, 3.3, 11.0, 33.0, and 100 percent sample + dilution water for the control.

Test Organism Conditions:

All organisms tested were fed and maintained during culturing, acclimation, and testing as prescribed by the EPA (2002).

The test organisms appeared vigorous and in good condition prior to testing.

C. dubia chronic test:

Source: TA-ASL's in-house cultures

Age: Less than 24 hours old and within an 8-hour age range, with blocking by known parentage
Design: Ten test vessels per concentration, one organism per vessel
Test Solution Renewal: Daily
Monitoring:

- Daily: Survival and neonate production (with brood determination)
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination:

- Survival: @ after 7 days.
- Reproduction: When 60%+ of surviving control organisms produce a 3rd brood.

Endpoints: Survival (at Day 7) and Reproduction (through first 3 broods)

P. promelas chronic test:

Source: Aquatox Inc., Hot Springs, Arkansas
Age: Less than 48 hours old and within an 24 hour age range
Design: Four test vessels per concentration, ten organisms per vessel
Test Solution Renewal: Daily
Monitoring:

- Daily: Survival
- Daily: DO and pH in pre and post-renewal solutions, all concentrations
- Daily: Temperature in pre-renewal solutions, all concentrations
- With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration

Termination: 7 days after test initiation.
Endpoints: Survival and Growth (average dry weight per organism added @ initiation)

DILUTION WATER

The dilution water used was the standard culture water used by TA-ASL:

Reconstituted, moderately hard water (as per EPA protocol) with a total hardness of 80 to 100 mg/L as $CaCO_3$ and an alkalinity of 60 to 70 mg/L as $CaCO_3$.

SAMPLE COLLECTION AND STORAGE

Samples were collected by Energy Northwest personnel. The samples were accepted by TA-ASL. Chain of Custody and Sample Receipt Records are provided in Appendix C.

All samples were received within the EPA recommended 0 to 6 ^{o}C range.
All samples were received within the WDOE required 0 to 6 ^{o}C range.

The samples collected on November 5 and 9, 2018 were accepted as scheduled by TA-ASL and were initially used for test initiation or test solution renewal within the EPA recommended maximum holding time of 36 hours of sample collection.

The sample collected on Wednesday, November 7, 2018 was delayed during shipment and accepted by TA-ASL on Friday, November 9, 2018.

- *C. dubia* and *P. promelas* test solution renewals performed on Thursday, November 8, 2018 were outside of the WDOE required holding time of a maximum of 72 hours past the time of collection but within the EPA recommended holding time of 72 hours past the time of initial use of that sample.
- Initial use of the November 7, 2018 sample on November 9, 2018 occurred outside of the EPA recommended maximum holding time of 36 hours of sample collection.
- All renewals conducted represented use of the freshest, good condition sample available and is in accordance with WDOE guidance.
- WDOE Pub#WQ-R-95-80, page 24 outlines 'rules for accepting 7-day tests' when sample holding conditions are not met. These include:

  "If the second sample arrives late, the test will be accepted if daily renewals were continued using the first sample and the second sample arrives with a good temperature."

Except as noted above, all samples were initially used for test initiation or test solution renewal within the EPA recommended and WDOE required maximum holding time of 36 hours of sample collection.

Except as noted above, all subsequent uses of a sample occurred within the EPA recommended maximum holding time of 72 hours past the time of initial use of that sample and WDOE required maximum holding time of 72 hours past the time of collection.

Following receipt, the samples were stored in the dark at 0 to 6 C until test solutions were prepared and tested.

SAMPLE PREPARATION

Samples used during these tests were:

Temperature adjusted prior to test initiation and each daily renewal.

Dechlorination with sodium thiosulfate was performed.

DATA ANALYSIS

The statistical analyses performed for the chronic tests were those outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, USEPA Office of Water, Fourth Edition (EPA 2002), EPA-821-R-02-013, using CETIS.

Additional guidance was provided by *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Washington State Department of Ecology (revised June 2016) Pub# WQ-R-95-80.

The specific statistical analysis and CETIS version used for each endpoint evaluation is listed with the statistical outputs included with each test in Appendix A.

If any additional analysis methods were also used, an explanation of the rationale and reference to the source method is included with the presentation of those results below.

RESULTS AND DISCUSSION

The raw data sheets are presented in Appendix A.

CHRONIC BIOASSAYS

Table 1 summarizes the survival and reproduction data for the *C. dubia* chronic test initiated on November 6, 2018.

Table 1
Summary of Chronic Results
C. dubia

Sample Concentration (%)	Percent Survival	Mean Number of Young Per Adult
Control	80	20.7
1.0	70	20.1
3.3	90	22.6
11.0	89	23.3
33.0	100	18.0
100	90	5.7 [a]

[a] Indicates a statistically significant difference from the control at alpha = 0.05.

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 33.0 %
LOEC = 100 %
IC_{25} = 38.7 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *C. dubia* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum 15 young produced per surviving control adult. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

Table 2 summarizes the survival and growth data for the *P. promelas* chronic test initiated on November 6, 2018.

Table 2
Summary of Chronic Results
P. promelas

Sample Concentration (%)	Percent Survival	Mean Dry Weight Per Organism Added (mg)
Control	100	0.905
1.0	92.5	0.869
3.3	100	0.961
11.0	100	0.927
33.0	100	0.856
100	86.7	0.878

Statistical analysis in accordance with the EPA protocol and WDOE guidance results in:

NOEC = 100 %
LOEC > 100 %
IC_{25} > 100 %

From the NPDES permit: There is no effluent limit listed for chronic toxicity. "The CCEC equals 1% effluent."

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at 25±1 C.

The *P. promelas* test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum weight of 0.250 mg per surviving control organism. Unless referenced above, the tests proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "valid".

REFERENCE TOXICANT TESTS

Reference toxicant (reftox) testing is performed to document both initial and ongoing laboratory performance of the test method(s). While the health of the test organisms is primarily evaluated by the performance of the laboratory control, reftox test results also may be used to assess the health and sensitivity of the test organisms. Reftox test results within their respective cumulative summary (Cusum) chart limits are indicative of consistent laboratory performance and normal test organism sensitivity.

The results of the reftox tests indicate that the test organisms were within their respective cusum chart limits based on EPA guidelines. This demonstrates ongoing laboratory proficiency of the test methods and suggests normal test organism sensitivity in the associated client testing.

The *C. dubia* chronic reftox test was conducted using sodium chloride. The *P. promelas* chronic reftox test was conducted using potassium chloride. The data sheets for the reference toxicant tests are provided in Appendix B.

Table 3 summarizes the reference toxicant test results and Cusum chart limits.

Table 3
Chronic Reference Toxicant Tests (g/L)

Species	IC_{25}	Cusum Chart Limits
C. dubia (survival)	1.91	1.13 to 2.15
C. dubia (reproduction)	0.92	0.22 to 1.25
P. promelas (survival)	0.59	0.57 to 0.65
P. promelas (growth)	0.58	0.44 to 0.72

APPENDIX A

RAW DATA SHEETS

TestAmerica

FRESHWATER TOXICITY TEST: SAMPLE AND DILUTION WATER DATA

Client: Energy Northwest — SDG # B 4141 — Test Initiation: Date 11-6-18

Contact: Jane LaPage (509) 377-4061 — Test Termination: Date 11-13-18

Sample ID Number	Field ID	Collected Date (mm/dd/yy)	Collected Time (Pacific Zone)	Received Date (mm/dd/yy)	Received Time (Pacific Zone)	Temp (°C) as Rc'vd	Total Residual Chlorine (mg/l) ☑ Dechlorination allowed as Rc'vd / after Dechlor.	Ammonia NH_3-N mg/l as Rc'vd	Hardness mg/l as $CaCO_3$ as Rc'vd	Alkalinity mg/l as $CaCO_3$ as Rc'vd	DO (mg/L) as Rc'vd	pH as Rc'vd	Cond. (uS) as Rc'vd	60 um filtered? (organisms noted)
B4141 -01	190440-01	11/05/18	05:30	11/06/18	10:00	4.5	0.03 / 0.04	<0.10	667	107	8.2	7.7	1105	☐
-02	* 190440-02	11/7/18	05:05	11/9/18	10:50	1.7	0.04 / 0.04	<0.10	635	108	8.8	8.2	971	☐
-03	190440-03	11/9/18	05:25	11/10/18	11:00	1.6	0.05 / 0.05	<0.10	505	105	8.9	7.9	846	☐
							/							
							/							
							/							
							/							
							/							
							/							
							/							
							/							
							/							
							/							
Reporting Limits:						na	0.02 mg/L	0.10 mg/L	5 mg/L	5 mg/L	na	na	na	na

Note: "-" Indicates data collection or dechlorination not needed. Any other adjustments to samples prior to use are documented in Comments below or on Dilutions page.

Dilution Water	ID#	Hardness mg/l as $CaCO_3$	Alkalinity mg/l as $CaCO_3$
Recon MH (FHM)	4744	93	70
	4746	88	68
RO/DI 11-10-18	4747	883	66
	4748	810	69

Comments: ☑ Indicates the action was taken, (☐= action not taken): " - " = sample not dechlorinated, or analyte not collected/needed.

☑ Dechlorination is **REQUIRED** if Total Residual Chlorine (TRC) is detected (i.e. TRC is 0.02 mg/L or greater).

From EPA manual (EPA-821-R-02-013, 8.8.7): 0.025 ml of a 26.8 g/L stock of sodium thiosulfate will reduce 0.10 mg/L TRC in a 1L sample.

(for example: **4**L of sample at **0.10** mg/L TRC needs **0.10** ml of 26.8g/L sodium thiosulfate stock to be dechlorinated)

-01 sample Calc: (20 L sample) x (0.03 mg/L TRC) x 0.25 = 0.15 ml of 26.8 g/L sodium thiosulfate to add (ID: 28070-04)

-02 sample Calc: (20 L sample) x (0.04 mg/L TRC) x 0.25 = 0.20 ml of 26.8 g/L sodium thiosulfate to add (ID: 28071-06)

-03 sample Calc: (20 L sample) x (0.05 mg/L TRC) x 0.25 = 0.25 ml of 26.8 g/L sodium thiosulfate to add (ID: 28071-04)

DO NOT add more sodium thiosulfate if "after Dechlor" TRC reading is not reduced to < 0.02 mg/L. Leave as is.

Water Quality Meters Used/ID#: Dissolved Oxygen # 4 pH # 11 Conductivity # 7

* -02 sample delay

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FRESHWATER TOXICITY TEST: TEST ORGANISM INFORMATION

Client Energy Northwest

Sample Designation (SDG): B 41141

Test Species Information	Cd # 3495 *Ceriodaphnia dubia* Chronic	FHM # 2017 *Pimephales promelas* Chronic			
Organism Age at Initiation	<24 hrs, all within an 8 hr window	<48 hrs, all within a 24 hour window			
Test Container Size	30 ml	800 ml			
Test Volume	15 ml	500 ml			
Feeding: Type and Amount	0.10 ml Algae and 0.10 ml YCT daily	0.15 ml *Artemia*, 2 x Daily			
Aeration: In Test Chambers via Slow Bubble :	☒ None ☐ Prior to use	☒ None ☐ Prior to use ☐ @ _____ hrs			
Acclimation Period	<24 hrs	<24 hrs			
Organism Source	In-House	Aquatox			
Size	-	-			
Loading Rate	-	-			

Dissolved Oxygen aeration justifications (in test chambers):

Test(s): ☐ All ☐ _____

Date:

Comments:

Test Solution Preparation and Dilution Record

Client: Energy Northwest

Note: ☐ Indicates task not done, ☑ Indicates task was done. Temp adj. = Temperature adjusted to ambient or test temp

Ditto marks ('') indicate that the same SDG, batch of dilution water, or food as the previous day's entry was used.

Ceriodaphnia dubia - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	200
1.0	2.00	→	200
3.3	6.60	→	200
11.0	22.0	→	200
33.0	66.0	→	200
100	200	→	200

Total Sample volume needed per day = 297 mls

Test Day	Sample ID Used		Daily Sample Preparation (prior to dilution)	Dilution Water Used	YCT ID Used	Algae ID Used	Date	Time	Initials
0 (Initiation)	B	4141 - 01	☐ Temp adj, ☐ Aerated	ID # 4744	# 1183	# 1184	11/6/2018	10 : 50	MB
1	B	- 01	☐ Temp adj, ☐ Aerated	ID # 4744	# 1183	# 1184	11/7/18	08:35	MB
* 2	B	-01	☐ Temp adj, ☐ Aerated	ID # 4744	# 1179	# 1187	11/8/18	10 55	O
3	B	-02	☐ Temp adj, ☐ Aerated	ID # 4747	# 1179	# 1187	11/9/18	11 :29	O
4	B	-03	☐ Temp adj, ☐ Aerated	ID # 4747	# 1183	# 1187	11 10/18	11 :30	O
5	B	03	☐ Temp adj, ☐ Aerated	ID # 4747	# 1183	# 1187	11/11/18	09 : 15	O
6	B	-03	☐ Temp adj, ☐ Aerated	ID # 4744	# 1179	# 1187	11 12/"	09:18	BM
7	B	-	☐ Temp adj, ☐ Aerated	ID #	#	#	/ /"	:	

Fathead minnow - Chronic

Test Concentration (%)	Sample Volume (mls)		Final Volume (mls)
Control	0.00	→	2000
1.0	20.0	→	2000
3.3	66.0	→	2000
11.0	220	→	2000
33.0	660	→	2000
100	2,000	→	2000

Total Sample volume needed per day = 2966 mls

Test Day	Sample ID Used		Daily Sample Preparation (prior to dilution)	Dilution Water Used	Date	Time	Initials
0 (Initiation)	B	4141 - 01	☐ Temp adj, ☐ Aerated	ID # 4744	11/6/2018	10 :55	MB
1	B	01	☐ Temp adj, ☐ Aerated	ID # 4744	11/7/18	08:30	MB
* 2	B	-01	☐ Temp adj, ☐ Aerated	ID # 4744	11 8/"18	10 55	O
3	B	- 02	☐ Temp adj, ☐ Aerated	ID # 4747	11 9/18	11 29	O
4	B	-03	☐ Temp adj, ☐ Aerated	ID # 4747	11 10/18	11 30	O
5	B	- 03	☐ Temp adj, ☐ Aerated	ID # 4747	11 11/18	09 15	O
6	B	-03	☐ Temp adj, ☐ Aerated	ID # 4744	11 12/"	09:18	BM

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: Energy Northwest Test Start Date: 11-6-18

Sample Description: _____ Initial Sample ID#: B 4141-01

Data summarized by: _____

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	25	25	24	27	26	23	27	14	6	10	8	207
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD? ✓	AD?		
1.0 %	22	19	28	15	25	27	24	14	14	13	7	201
	AD?	AD?	AD? ✓	AD? ✓	AD?	AD?	AD?	AD? ✓	AD?	AD?		
3.3 %	13	31	30	29	15	31	20	29	14	14	9	226
	AD?	AD?	AD?	AD?	AD?	AD?	AD? ✓	AD?	AD?	AD?		
11.0 %	AM	20	32	16	27	32	32	25	12	14	8/9	210 (+23 = 233)
	AD?	AD?	AD?	AD? ✓	AD?	AD?	AD?	AD?	AD?	AD?		
33.0 %	7	29	30	11	15	25	23	29	6	5	10	180
	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		
100 %	0	17	11	2	9	9	1	5	3	0	9	57
	AD? ✓	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?	AD?		

Survival data summarized through Day 7. 60%+ of surviving controls with 3+ broods first observed on Day 6.

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination (for WDOE only, = Number of test organisms alive at Day 7)

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CERIODAPHNIA CHRONIC SURVIVAL AND REPRODUCTION DATA

Neo's obtained from	A	B	C	D	E	F	G	H	I	J
Culture Board ID:	E	E	E	E	E	E	E	E	E	E
Slot #:	18	28	13	22	32	5	20	57	30	7

Incubator Used: # 6
Random Template Used: 6 conc # 19

Client: Energy Northwest
Test Initiation: Date: 11/6/2018 Time: 11:30
Sample Description:
Initial Sample ID # B4141-01
Termination: Date: 11/13/2018 Time: 10:20

Technician: Day 0 BC | Day 1 MB | Day 2 ~~0~~ | Day 3 ~~0~~ | Day 4 ~~0~~ | Day 5 BAM | Day 6 BM | Day 7 ~~0~~ | Day 8
Time: Day 0 1130 | Day 1 1020 | Day 2 1315 | Day 3 1230 | Day 4 1250 | Day 5 1615 | Day 6 1445 | Day 7 1020 | Day 8

Percent	Day	Daily Number of Live Young for each Replicate A	B	C	D	E	F	G	H	I	J	No. Live Adults	Daily Total Live Young
Control	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	0	0	5	0	4	3	0	0	10	12
	4	5	5	4	3	0	3	0	0	6	3	10	29
	5	8	9	8	11	10	10	8	11	OAD	7	9/10	82
	6	12	11	12	13	11	10	15	OAD	|	0	8	84
	7								5			8	—
	8												
1.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	3	4	0	3	0	4	0	0	10	14
	4	3	0	0	0	0	0	0	0	5	4	10	12
	5	6	9	9	11AD	9	10	10	10AD	9	9	8	92
	6	13	10	16	|	16	14	14	|	0	0	8	83
	7			AD								7	—
	8												
3.3 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	4	4	5	0	0	0	4	0	0	10	17
	4	3	0	0	0	5	3	4	0	4	4	10	23
	5	10	11	11	10	0	11	7	11	10	10	10	91
	6	0	16	15	14	10	17	9	14	0	0	10	95
	7							AD				9	—
	8												
11.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	DAM	0	0	0	0	0	0	0	0	0	9/9	0
	3	|	0	5	5	4	4	0	5	0	0	9	23
	4	|	3	0	0	0	0	5	0	4	4	9	16
	5	|	12	10	11AD	10	11	10	9	8	0	8	81
	6	|	5	17	|	13	17	17	11	0	10	8/9	90
	7	|		|							8	—
	8	↓											
33.0 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	2	0	0	0	3	0	0	0	0	10	5
	4	2	0	6	2	2	0	3	3	0	2	10	20
	5	5	12	10	9	9	6	7	9	6	3	10	76
	6	3	15	14	0	4	16	13	17	0	0	10	78
	7											10	—
	8												
100 %	1	0	0	0	0	0	0	0	0	0	0	10	0
	2	0	0	0	0	0	0	0	0	0	0	10	0
	3	0	0	0	0	0	0	0	0	0	0	10	0
	4	0	0	0	0	0	0	0	0	3	OA 4	10	3
	5	OAD	0	4	OA4	OAY	OAY	OA4	OA4	0	OA4	9	4
	6	|	17	7	2	9	9	1	5	0	0	9	50
	7	|										9	—
	8												

"AD" = Adult Dead, "AY" = Aborted young, "M" = male organism, "F" = Female, "R" = Adult releasing young, " / " = split brood (carry-over brood / current day brood), "Inj" = Adult Injured during test solution renewal, replicate removed from analysis. "AM" = Adult missing, remove from analysis. A circled neonate count = 4th brood

Footnote: As per WDOE, C. dubia test reproduction should be when 60% of the surviving control organisms have produced their third brood (Days 6, 7, or 8). Survival is at seven days.

TestAmerica

CERIODAPHNIA WATER QUALITY DATA

Client: Energy Northwest
Sample Description:
Initiated Date: 11/6/20 Time: 11:30
Initial Sample ID #: B 4141 - 4
Adults Isolated Date: 11/5/20 Time: 12:30
Neo's Collected Date: 11/5/20 Time: 17:30

		Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Tech:		BM/NB	NB				BAM	BM		
Time		14:35	11:10	13:15	12:30	12:50	17:00	14:50	10:20	:
Therm.		# 250	# 252	# 252	# 252	# 252	# 252	# 252	# 252	#

Dissolved Oxygen (mg/l)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.1	7.0 / 7.1	7.9 / 7.0	7.6 / 7.2	7.4 / 7.2	7.5 / 7.3	7.9 / 7.4	7.7	
1.0 %	7.2	7.1 / 7.3	7.7 / 7.2	7.7 / 7.4	7.6 / 7.3	7.5 / 7.3	7.9 / 7.5	7.8	
3.3 %	7.2	7.2 / 7.3	7.7 / 7.3	7.7 / 7.4	7.6 / 7.3	7.5 / 7.4	8.0 / 7.3	7.7	
11.0 %	7.3	7.2 / 7.4	7.6 / 7.3	7.6 / 7.3	7.7 / 7.3	7.5 / 7.5	8.1 / 7.4	7.8	
33.0 %	7.3	7.4 / 7.3	7.3 / 7.4	7.6 / 7.4	7.7 / 7.3	7.6 / 7.5	8.1 / 7.4	7.8	
100 %	7.3	7.4 / 7.4	7.6 / 7.3	7.7 / 7.4	7.8 / 7.4	7.7 / 7.4	8.1 / 7.6	7.8	

pH

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	7.6	7.9 / 8.1	8.1 / 8.2	7.9 / 8.1	8.0 / 8.0	8.0 / 8.0	8.0 / 8.0	7.7	
1.0 %	7.7	7.9 / 8.1	8.1 / 8.2	7.9 / 8.1	8.0 / 8.1	8.0 / 8.0	8.0 / 8.0	7.8	
3.3 %	7.8	7.9 / 8.1	8.1 / 8.2	7.9 / 8.1	8.0 / 8.1	8.0 / 8.0	8.0 / 8.0	7.7	
11.0 %	7.8	7.8 / 8.0	8.1 / 8.2	7.9 / 8.1	8.0 / 8.0	8.0 / 8.0	8.0 / 8.0	7.7	
33.0 %	7.8	7.8 / 8.0	8.0 / 8.1	7.8 / 8.0	7.9 / 8.0	7.8 / 8.0	8.0 / 7.9	7.7	
100 %	7.9	7.8 / 7.9	8.0 / 8.0	7.8 / 7.9	7.9 / 7.9	7.8 / 7.9	8.0 / 7.9	7.6	

Temperature (°C) / Conductivity (µS) (1st use of each sample only)

%	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Control	24.9 / 300	24.5	25.7	25.6 / 299	24.3 / 299	24.9	25.1	26.0	
1.0 %	24.8 / 327	24.4	24.9	25.6 / 305	24.3 / 312	24.3	25.5	25.8	
3.3 %	24.8 / 338	24.6	25.2	25.3 / 333	24.1 / 328	24.0	24.6	24.1	
11.0 %	24.7 / 422	24.6	25.6	25.4 / 400	24.2 / 370	24.2	25.1	24.5	
33.0 %	24.8 / 628	24.1	24.5	24.8 / 560	24.7 / 522	24.9	25.6	25.6	
100 %	24.6 / 1154	24.2	24.2	24.8 / 1038	24.1 / 910	25.0	25.3	25.0	

COMMENTS: Temperatures taken just prior to test solution renewals. DO, pH, and Conductivity taken following organism transfer.

23.8 = Temp out of recom. range

Note: All Day 0 data represents conditions at initiation. All other days: numerator represents pre-renewal conditions, denominator represents post-renewal conditions.

CETIS Summary Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Batch ID:	01-8993-0902	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 11:30	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 10:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	<24H

Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (4.5 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
11-0179-2170	7d Survival Rate	100	>100	NA	NA	1	Fisher Exact/Bonferroni-Holm Test
09-5182-9632	Reproduction	33	100	57.45	40.2%	3.03	Wilcoxon/Bonferroni Adj Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
09-8176-5866	Reproduction	IC25	38.65	18.87	53.51	2.587	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
11-0179-2170	7d Survival Rate	Control Resp	0.8	0.8 - NL	Yes	Passes Acceptability Criteria
09-5182-9632	Reproduction	Control Resp	20.7	15 - NL	Yes	Passes Acceptability Criteria
09-8176-5866	Reproduction	Control Resp	20.7	15 - NL	Yes	Passes Acceptability Criteria
09-5182-9632	Reproduction	PMSD	0.4017	0.13 - 0.47	Yes	Passes Acceptability Criteria

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	0.8	0.4984	1	0	1	0.1333	0.4216	52.7%	0.0%
1		10	0.7	0.3544	1	0	1	0.1528	0.483	69.01%	12.5%
3.3		10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	-12.5%
11		9	0.8889	0.6327	1	0	1	0.1111	0.3333	37.5%	-11.11%
33		10	1	1	1	1	1	0	0	0.0%	-25.0%
100		10	0.9	0.6738	1	0	1	0.1	0.3162	35.14%	-12.5%

Reproduction Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	20.7	15.18	26.22	6	27	2.441	7.718	37.28%	0.0%
1		10	20.1	15.94	24.26	13	28	1.841	5.82	28.96%	2.9%
3.3		10	22.6	16.85	28.35	13	31	2.544	8.044	35.59%	-9.18%
11		9	23.33	17.12	29.54	12	32	2.693	8.078	34.62%	-12.72%
33		10	18	10.64	25.36	5	30	3.252	10.28	57.14%	13.04%
100		10	5.7	1.667	9.733	0	17	1.783	5.638	98.92%	72.46%

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	0	0	1
1		1	1	0	0	1	1	1	0	1	1
3.3		1	1	1	1	1	1	0	1	1	1
11		1	1	0	1	1	1	1	1	1	
33		1	1	1	1	1	1	1	1	1	1
100		0	1	1	1	1	1	1	1	1	1

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	25	25	24	27	26	23	27	14	6	10
1		22	19	28	15	25	27	24	14	14	13
3.3		13	31	30	29	15	31	20	29	14	14
11		20	32	16	27	32	32	25	12	14	
33		7	29	30	11	15	25	23	29	6	5
100		0	17	11	2	9	9	1	5	3	0

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	0/1	1/1
1		1/1	1/1	0/1	0/1	1/1	1/1	1/1	0/1	1/1	1/1
3.3		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
11		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	
33		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	11-0179-2170	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:20	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	01-8993-0902	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 11:30	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 10:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	<24H
Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (4.5 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	NOEL	LOEL	TOEL	TU
Untransformed		C > T	NA	NA	100	>100	NA	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	C-%	Test Stat	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	0.5	1.0000	Exact	Non-Significant Effect
		3.3	1	1.0000	Exact	Non-Significant Effect
		11	1	1.0000	Exact	Non-Significant Effect
		33	1	1.0000	Exact	Non-Significant Effect
		100	1	1.0000	Exact	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.8	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Dilution Water	8	2	10	0.8	0.2	0.0%
1		7	3	10	0.7	0.3	12.5%
3.3		9	1	10	0.9	0.1	-12.5%
11		8	1	9	0.8889	0.1111	-11.11%
33		10	0	10	1	0	-25.0%
100		9	1	10	0.9	0.1	-12.5%

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	1	1	1	1	1	1	0	0	1
1		1	1	0	0	1	1	1	0	1	1
3.3		1	1	1	1	1	1	0	1	1	1
11		1	1	0	1	1	1	1	1	1	
33		1	1	1	1	1	1	1	1	1	1
100		0	1	1	1	1	1	1	1	1	1

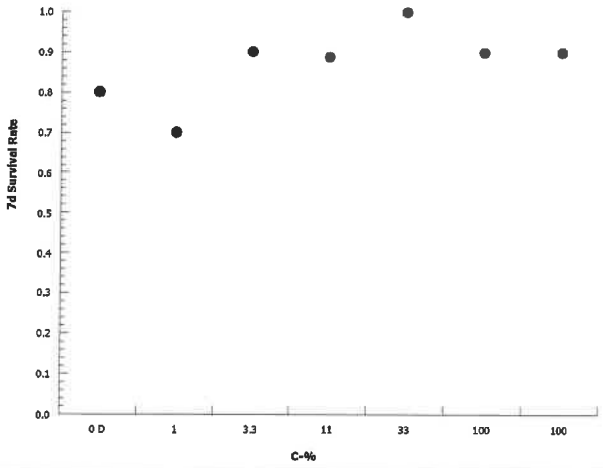
7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	0/1	1/1
1		1/1	1/1	0/1	0/1	1/1	1/1	1/1	0/1	1/1	1/1
3.3		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
11		1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	
33		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	11-0179-2170	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:20	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — TestAmerica - ASL

Analysis ID:	09-5182-9632	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:24	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	01-8993-0902	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 11:30	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 10:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	<24H
Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (4.5 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C > T	NA	NA	40.2%	33	100	57.45	3.03

Wilcoxon/Bonferroni Adj Test

Control	vs	C-%	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	100.5	NA	5	18	1.0000	Exact	Non-Significant Effect
		3.3	118	NA	1	18	1.0000	Exact	Non-Significant Effect
		11	100.5	NA	4	17	1.0000	Exact	Non-Significant Effect
		33	101	NA	3	18	1.0000	Exact	Non-Significant Effect
		100*	62	NA	0	18	0.0011	Exact	Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	20.7	15 - NL	Yes	Passes Acceptability Criteria
PMSD	0.4017	0.13 - 0.47	Yes	Passes Acceptability Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2091.381	418.2763	5	6.964	<0.0001	Significant Effect
Error	3183.5	60.06604	53			
Total	5274.881		58			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.339	15.09	0.5017	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.942	0.9451	0.0073	Non-normal Distribution

Reproduction Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	10	20.7	15.18	26.22	24.5	6	27	2.441	37.28%	0.0%
1		10	20.1	15.94	24.26	20.5	13	28	1.841	28.96%	2.9%
3.3		10	22.6	16.85	28.35	24.5	13	31	2.544	35.59%	-9.18%
11		9	23.33	17.12	29.54	25	12	32	2.693	34.62%	-12.72%
33		10	18	10.64	25.36	19	5	30	3.252	57.14%	13.04%
100		10	5.7	1.667	9.733	4	0	17	1.783	98.92%	72.46%

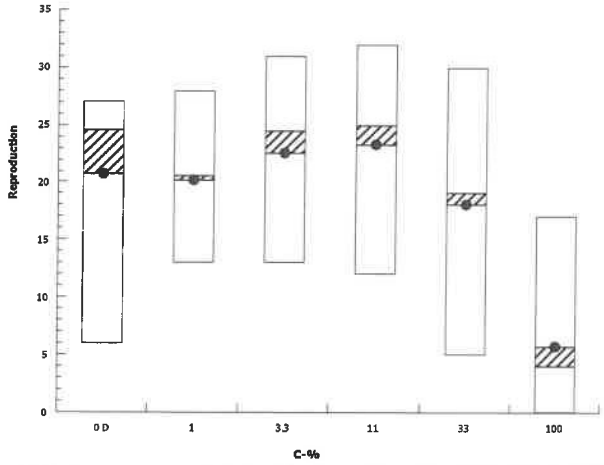
Reproduction Detail

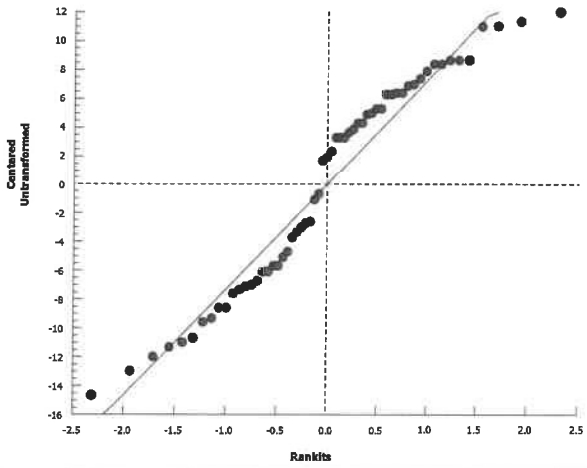
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	25	25	24	27	26	23	27	14	6	10
1		22	19	28	15	25	27	24	14	14	13
3.3		13	31	30	29	15	31	20	29	14	14
11		20	32	16	27	32	32	25	12	14	
33		7	29	30	11	15	25	23	29	6	5
100		0	17	11	2	9	9	1	5	3	0

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	09-5182-9632	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:24	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **TestAmerica - ASL**

Analysis ID:	09-8176-5866	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:24	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Batch ID:	01-8993-0902	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 11:30	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 10:20	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 23h	**Source:**	In-House Culture	**Age:**	<24H

Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	30h (4.5 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1212199	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	20.7	15 - NL	Yes	Passes Acceptability Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	38.65	18.87	53.51	2.587	1.869	5.3

Reproduction Summary

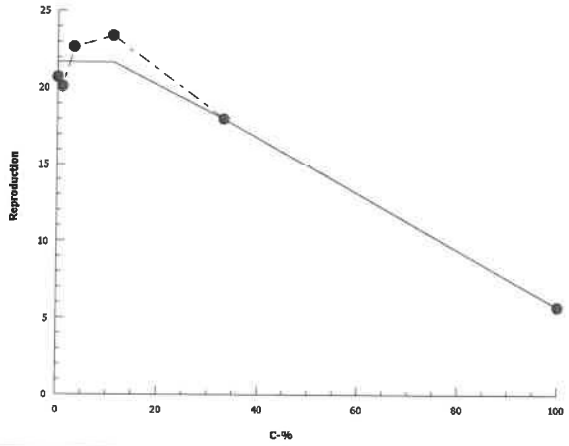
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	20.7	6	27	2.441	7.718	37.28%	0.0%
1		10	20.1	13	28	1.841	5.82	28.96%	2.9%
3.3		10	22.6	13	31	2.544	8.044	35.59%	-9.18%
11		9	23.33	12	32	2.693	8.078	34.62%	-12.72%
33		10	18	5	30	3.252	10.28	57.14%	13.04%
100		10	5.7	0	17	1.783	5.638	98.92%	72.46%

Reproduction Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	25	25	24	27	26	23	27	14	6	10
1		22	19	28	15	25	27	24	14	14	13
3.3		13	31	30	29	15	31	20	29	14	14
11		20	32	16	27	32	32	25	12	14	
33		7	29	30	11	15	25	23	29	6	5
100		0	17	11	2	9	9	1	5	3	0

Ceriodaphnia 7-d Survival and Reproduction Test					TestAmerica - ASL
Analysis ID:	09-8176-5866	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:24	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 1 | Waterbath/incubator Used: # 3 | Date Initiated 11 / 10 / 2018 Time 15 : 10

Initial sample ID B 4141 - 01 | Date Terminated 11 / 13 / 2018 Time 13 : 10

Client: Energy Northwest | Sample Description:

Tech: Day 0 MB Day 1 [illegible] Day 2 BAM Day 3 MB/[illegible] Day 4 [illegible] Day 5 BAM Day 6 BAM Day 7 [illegible]

Time: Day 0 1510 Day 1 1356 Day 2 1310 Day 3 1300 Day 4 1335 Day 5 1730 Day 6 1735 Day 7 1310

Conc. or Percent	Day	Number of Live Organisms A	B	C	D	Dissolved O_2 (mg/l) Pre	Post	pH Pre	Post	Temp. (°C) Pre	Therm. ID #	Conductivity (µS) Post (1st use)
Control	0	10	10	10	10		7.8		8.4	Post: 24.6	252	302
	1	10	10	10	10	6.8	7.1	8.2	8.3	24.3	252	
	2	10	10	10	10	6.3	7.3	8.1	8.3	24.7	255	321
	3	10	10	10	10	6.5	6.6	7.7	8.1	24.6	255	294
	4	10	10	10	10	6.1	7.0	7.6	8.0	24.4	255	299
	5	10	10	10	10	6.9	7.0	8.0	8.2	24.7	255	
	6	10	10	10	10	7.6	7.5	8.1	8.2	24.7	255	
	7	10	10	10	10	7.2		7.8		24.7	255	
1.0 %	0	10	10	10	10		7.8		8.4	Post: 24.6		316
	1	10	10	10	10	6.6	7.3	8.2	8.3	24.2		
	2	10	9	10	10	6.3	7.5	8.1	8.4	24.7		330
	3	10	9	9	10	6.6	6.9	7.3	8.1	24.6		309
	4	10	9	9	10	6.2	7.3	7.6	8.1	24.4		310
	5	10	9	9	10	6.7	7.2	8.0	8.3	24.6		
	6	10	9	9	10	7.5	7.6	8.1	8.2	24.6		
	7	10	8	9	10	7.2		7.8		24.7		
3.3 %	0	10	10	10	10		7.7		8.4	Post: 24.6		341
	1	10	10	10	10	6.5	7.4	8.1	8.3	24.2		
	2	10	10	10	10	6.2	7.6	8.1	8.5	24.7		357
	3	10	10	10	10	6.5	7.3	7.3	8.1	24.6		324
	4	10	10	10	10	6.2	7.6	7.6	8.1	24.4		327
	5	10	10	10	10	6.5	7.3	8.1	8.3	24.6		
	6	10	10	10	10	7.5	7.8	8.1	8.2	24.6		
	7	10	10	10	10	7.3		7.7		24.7		
11.0 %	0	10	10	10	10		7.7		8.3	Post: 24.6		415
	1	10	10	10	10	6.5	7.4	8.1	8.3	24.3		
	2	10	10	10	10	6.2	7.7	8.0	8.5	24.7		424
	3	10	10	10	10	6.5	7.5	7.3	8.1	24.6		383
	4	10	10	10	10	6.2	7.7	7.6	8.1	24.4		374
	5	10	10	10	10	6.5	7.5	8.0	8.3	24.6		
	6	10	10	10	10	7.4	7.9	8.0	8.2	24.7		
	7	10	10	10	10	7.3		7.7		24.7		
33.0 %	0	10	10	10	10		7.7		8.2	Post: 24.6		624
	1	10	10	10	10	6.5	7.4	8.0	8.2	24.1		
	2	10	10	10	10	6.2	7.8	7.9	8.3	24.6		634
	3	10	10	10	10	6.5	7.7	7.3	8.1	24.6		559
	4	10	10	10	10	6.2	7.5	7.6	8.1	24.4		512
	5	10	10	10	10	6.4	7.6	8.0	8.2	24.7		
	6	10	10	10	10	7.4	7.9	7.9	8.1	24.6		
	7	10	10	10	10	7.2		7.6		24.7		
100 %	0	10	10	10	10		7.7		8.0	Post: 24.6		1173
	1	9	10	10	10	6.4	7.5	7.9	8.1	24.3		
	2	9	10	10	10	6.2	8.2	7.9	8.2	24.7		1169
	3	9	10	10	10	6.5	8.0	7.2	7.9	24.6		1020
	4	9	*	10	10	6.2	8.1	7.4	7.9	24.4		901
	5	9		10	10	6.4	7.9	7.8	8.1	24.7		
	6	9		10	10	7.4	8.2	7.8	8.0	24.7		
	7	9		10	7F	7.1		7.5		24.7		

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.
☐ Aeration in test chambers begun @ _____ (Note observations on Test Organism Info sheet)

Pre =Pre-renewal solutions. Post =Post-renewal solutions.
Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
(23.8) = Temp. out of recommended range

* rep spilled on 11-10-18

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy NW | Tins Labeled As: ENW

Lab ID: B4191 | Start Date: 11/6/2018

Sample Description:

Technician:		BAM
Date:		11/12/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A		1098.10	10
	B		1105.75	10
	C		1109.57	10
	D		1082.78	10
1 %	A		1086.35	10
	B		1090.31	8
	C		1109.91	9
	D		1102.29	10
3.3 %	A		1080.98	10
	B		1102.75	10
	C		1100.31	10
	D		1109.05	10
11 %	A		1090.46	10
	B		1124.02	10
	C		1095.22	10
	D		1086.21	10
33 %	A		1107.32	10
	B		1085.92	10
	C		1113.02	10
	D		1089.00	10
100 %	A		1092.98	9
	B		1099.50	rep spilled
	C		1124.61	10
	D		1123.81	7
	A			
	B			
	C			
	D			

weigh to 0.01 mg

FATHEAD MINNOW 7-DAY GROWTH DATA

Client: Energy NW | Tins Labeled As: ENW

Lab ID: B4141 | Start Date: 11/6/2018

Sample Description:

Technician:	MB	BAM
Date:	11/9/2018	11/12/2018
Balance Serial #:	B328543647	B328543647

Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
Control	A	1107.38	1098.10	10
	B	1115.70	1105.75	10
	C	1118.64	1109.57	10
	D	1090.69	1082.78	10
1 %	A	1095.98	1086.35	10
	B	1098.05	1090.31	8
	C	1117.98	1109.91	9
	D	1111.60	1102.29	10
3.3 %	A	1090.48	1080.98	10
	B	1113.47	1102.75	10
	C	1109.72	1100.31	10
	D	1117.85	1109.05	10
11 %	A	1099.31	1090.46	10
	B	1134.17	1124.02	10
	C	1104.82	1095.22	10
	D	1094.69	1086.21	10
33 %	A	1116.83	1107.32	10
	B	1094.23	1085.92	10
	C	1122.23	1113.02	10
	D	1096.20	1089.00	10
100 %	A	1102.67	1092.98	9
	B		1099.50	-
	C	1134.17	1124.61	10
	D	1130.89	1123.81	7
	A			
	B			
	C			
	D			

weigh to 0.01 mg

CETIS Summary Report

Fathead Minnow 7-d Larval Survival and Growth Test — TestAmerica - ASL

Batch ID:	17-0146-7237	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 15:10	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 13:10	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 22h	**Source:**	Aquatox, AR	**Age:**	1D

Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	34h (4.5 °C)	**Station:**			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
19-7532-0055	7d Survival Rate	100	>100	NA	NA	1	Fisher Exact/Bonferroni Adj Test
03-7177-7068	Mean Dry Biomass-mg	100	>100	NA	20.9%	1	Bonferroni Adj t Test

Point Estimate Summary

Analysis ID	Endpoint	Level	%	95% LCL	95% UCL	TU	Method
11-9808-0149	Mean Dry Biomass-mg	IC25	>100	N/A	N/A	<1	Linear Interpolation (ICPIN)

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
19-7532-0055	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
03-7177-7068	Mean Dry Biomass-mg	Control Resp	0.9052	0.25 - NL	Yes	Passes Acceptability Criteria
11-9808-0149	Mean Dry Biomass-mg	Control Resp	0.9052	0.25 - NL	Yes	Passes Acceptability Criteria
03-7177-7068	Mean Dry Biomass-mg	PMSD	0.2095	0.12 - 0.3	Yes	Passes Acceptability Criteria

7d Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
1		4	0.925	0.7727	1	0.8	1	0.04787	0.09574	10.35%	7.5%
3.3		4	1	1	1	1	1	0	0	0.0%	0.0%
11		4	1	1	1	1	1	0	0	0.0%	0.0%
33		4	1	1	1	1	1	0	0	0.0%	0.0%
100		3	0.8667	0.4872	1	0.7	1	0.08819	0.1528	17.63%	13.33%

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.9052	0.7701	1.04	0.791	0.995	0.04246	0.08491	9.38%	0.0%
1		4	0.8687	0.7219	1.016	0.774	0.963	0.04614	0.09228	10.62%	4.03%
3.3		4	0.9607	0.8328	1.089	0.88	1.072	0.04021	0.08042	8.37%	-6.13%
11		4	0.927	0.8078	1.046	0.848	1.015	0.03746	0.07492	8.08%	-2.4%
33		4	0.8557	0.6905	1.021	0.72	0.951	0.05194	0.1039	12.14%	5.47%
100		3	0.8777	0.5123	1.243	0.708	0.969	0.08492	0.1471	16.76%	3.05%

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
1		1	0.8	0.9	1
3.3		1	1	1	1
11		1	1	1	1
33		1	1	1	1
100		0.9	1	0.7	

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.928	0.995	0.907	0.791
1		0.963	0.774	0.807	0.931
3.3		0.95	1.072	0.941	0.88
11		0.885	1.015	0.96	0.848
33		0.951	0.831	0.921	0.72
100		0.969	0.956	0.708	

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	10/10
1		10/10	8/10	9/10	10/10
3.3		10/10	10/10	10/10	10/10
11		10/10	10/10	10/10	10/10
33		10/10	10/10	10/10	10/10
100		9/10	10/10	7/10	

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — TestAmerica - ASL

Analysis ID:	19-7532-0055	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:34	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes
Batch ID:	17-0146-7237	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 15:10	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 13:10	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 22h	**Source:**	Aquatox, AR	**Age:**	1D
Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	34h (4.5 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	NOEL	LOEL	TOEL	TU
Untransformed		C > T	NA	NA	100	>100	NA	1

Fisher Exact/Bonferroni Adj Test

Control	vs	C-%	Test Stat	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	0.1203	0.6013	Exact	Non-Significant Effect
		3.3	1	1.0000	Exact	Non-Significant Effect
		11	1	1.0000	Exact	Non-Significant Effect
		33	1	1.0000	Exact	Non-Significant Effect
		100	0.02989	0.1494	Exact	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Dilution Water	40	0	40	1	0	0.0%
1		37	3	40	0.925	0.075	7.5%
3.3		40	0	40	1	0	0.0%
11		40	0	40	1	0	0.0%
33		40	0	40	1	0	0.0%
100		26	4	30	0.8667	0.1333	13.33%

7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
1		1	0.8	0.9	1
3.3		1	1	1	1
11		1	1	1	1
33		1	1	1	1
100		0.9	1	0.7	

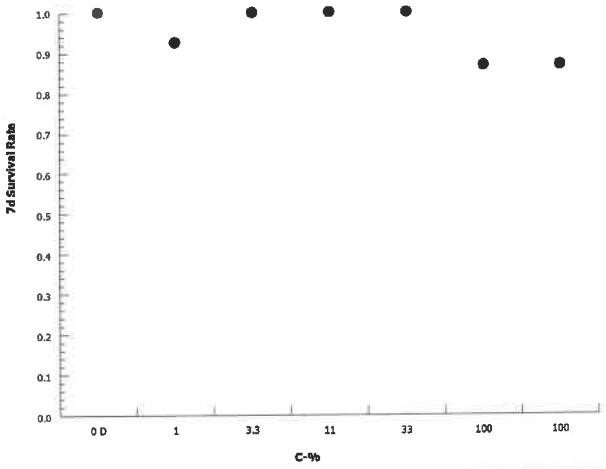
7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	10/10
1		10/10	8/10	9/10	10/10
3.3		10/10	10/10	10/10	10/10
11		10/10	10/10	10/10	10/10
33		10/10	10/10	10/10	10/10
100		9/10	10/10	7/10	

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	19-7532-0055	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:34	**Analysis:**	STP 2x2 Contingency Tables	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — TestAmerica - ASL

Analysis ID:	03-7177-7068	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:33	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes
Batch ID:	17-0146-7237	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 15:10	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 13:10	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 22h	**Source:**	Aquatox, AR	**Age:**	1D
Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	34h (4.5 °C)	**Station:**			

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	NOEL	LOEL	TOEL	TU
Untransformed	NA	C > T	NA	NA	20.9%	100	>100	NA	1

Bonferroni Adj t Test

Control	vs	C-%	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Dilution Water		1	0.5337	2.567	0.176	6	1.0000	CDF	Non-Significant Effect
		3.3	-0.8114	2.567	0.176	6	1.0000	CDF	Non-Significant Effect
		11	-0.318	2.567	0.176	6	1.0000	CDF	Non-Significant Effect
		33	0.7237	2.567	0.176	6	1.0000	CDF	Non-Significant Effect
		100	0.3733	2.567	0.19	5	1.0000	CDF	Non-Significant Effect

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.9052	0.25 - NL	Yes	Passes Acceptability Criteria
PMSD	0.2095	0.12 - 0.3	Yes	Passes Acceptability Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.03102268	0.006204536	5	0.6631	0.6563	Non-Significant Effect
Error	0.1590606	0.009356508	17			
Total	0.1900833		22			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	1.403	15.09	0.9239	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9286	0.88	0.1019	Normal Distribution

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	4	0.9052	0.7701	1.04	#Error	0.791	0.995	0.04246	9.38%	0.0%
1		4	0.8687	0.7219	1.016	#Error	0.774	0.963	0.04614	10.62%	4.03%
3.3		4	0.9607	0.8328	1.089	#Error	0.88	1.072	0.04021	8.37%	-6.13%
11		4	0.927	0.8078	1.046	#Error	0.848	1.015	0.03746	8.08%	-2.4%
33		4	0.8557	0.6905	1.021	#Error	0.72	0.951	0.05194	12.14%	5.47%
100		3	0.8777	0.5123	1.243	#Error	0.708	0.969	0.08492	16.76%	3.05%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	D	0.928	0.995	0.907	0.791
1		0.963	0.774	0.807	0.931
3.3		0.95	1.072	0.941	0.88
11		0.885	1.015	0.96	0.848
33		0.951	0.831	0.921	0.72
100		0.969	0.956	0.708	

Fathead Minnow 7-d Larval Survival and Growth Test					TestAmerica - ASL
Analysis ID:	03-7177-7068	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:33	**Analysis:**	Parametric-Multiple Comparison	**Official Results:**	Yes

CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **TestAmerica - ASL**

Analysis ID:	11-9808-0149	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:33	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Batch ID:	17-0146-7237	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Michelle Bennett
Start Date:	06 Nov-18 15:10	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	13 Nov-18 13:10	**Species:**	Pimephales promelas	**Brine:**	
Duration:	6d 22h	**Source:**	Aquatox, AR	**Age:**	1D

Sample ID:	05-9824-7280	**Code:**	B4141-01	**Client:**	
Sample Date:	05 Nov-18 05:30	**Material:**	Unknown	**Project:**	
Receive Date:	06 Nov-18 10:00	**Source:**	Energy Northwest (WA 0025151)		
Sample Age:	34h (4.5 °C)	**Station:**			

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1690036	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.9052	0.25 - NL	Yes	Passes Acceptability Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	N/A	N/A	<1	NA	NA

Mean Dry Biomass-mg Summary

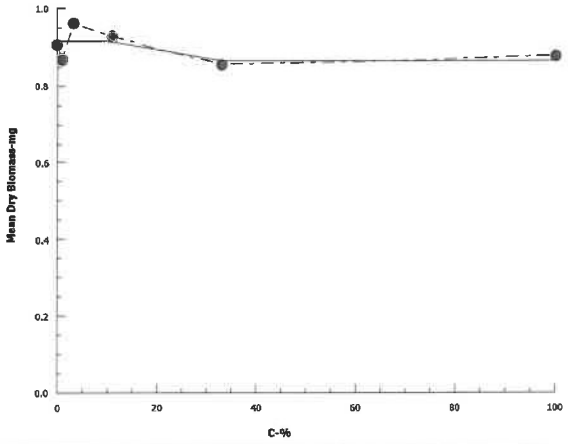
			Calculated Variate						
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.9052	0.791	0.995	0.04246	0.08491	9.38%	0.0%
1		4	0.8687	0.774	0.963	0.04614	0.09228	10.62%	4.03%
3.3		4	0.9607	0.88	1.072	0.04021	0.08042	8.37%	-6.13%
11		4	0.927	0.848	1.015	0.03746	0.07492	8.08%	-2.4%
33		4	0.8557	0.72	0.951	0.05194	0.1039	12.14%	5.47%
100		3	0.8777	0.708	0.969	0.08492	0.1471	16.76%	3.05%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.928	0.995	0.907	0.791
1		0.963	0.774	0.807	0.931
3.3		0.95	1.072	0.941	0.88
11		0.885	1.015	0.96	0.848
33		0.951	0.831	0.921	0.72
100		0.969	0.956	0.708	

Fathead Minnow 7-d Larval Survival and Growth Test					TestAmerica - ASL
Analysis ID:	11-9808-0149	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.8.8
Analyzed:	26 Nov-18 13:33	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



APPENDIX B

REFERENCE TOXICANT DATA SHEETS

Ceriodaphnia dubia
Survival and Reproduction
Test Data Summary

Client: QA / QC Test Start Date: 10-30-18

Sample Description: NaCl Initial Sample ID#: 2B 06806

Data summarized by: BV

Percent or Concentration	Total Live Young Produced in First 3 Broods per Replicate										# Alive Adults	Total Live Young
	A	B	C	D	E	F	G	H	I	J		
Control	19 AD?	22 AD?	23 AD?	15 AD?	27 AD?	24 AD?	23 AD?	19 AD?	24 AD?	15 AD?	10	211
0.25 g/L	14 AD?	25 23 AD?	24 AD?	20 AD?	18 AD?	28 AD?	22 AD?	23 AD?	23 AD?	11 AD?	10	206
0.50 g/L	15 AD?	17 AD?	27 AD?	21 AD?	23 AD?	22 AD?	20 AD?	19 AD?	20 AD?	10 AD?	10	194
1.0 g/L	19 AD?	8 AD?	13 AD?	17 AD?	22 AD?	9 AD?	16 AD?	16 AD?	17 AD?	15 AD?	10	182
1.5 g/L	13 AD?	7 AD?	8 AD?	12 AD?	6 AD?	10 AD?	14 AD?	12 AD?	9 AD?	0 AD?	10	91
2.0 g/L	0 AD?	0 AD?	0 AD?	0 AD?	2 AD?	0 AD? ✓	2 AD?	0 AD? ✓	0 AD? ✓	0 AD?	7	4
4.0 g/L	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0 AD? ✓	0	0

Test Organism Mortality (Adult dead) = AD? ✓

Test Organism identified as Male = AD? M

Test Organism Injured during test = AD? I

# of Alive Adults = Number of test organism alive at termination

Total Live Young = Total neonates produced in first 3 broods

Footnote: As per EPA-600-4-91-002 and EPA-821-R-02-013, *Ceriodaphnia dubia* test should be terminated when 60% of the surviving control organisms have produced their third brood, or at the end of eight days, whichever occurs first.

Also as per EPA-821-R-02-013 (13.10.9.1), "In this three-brood test, offspring from fourth or higher broods should not be counted and should not be included in the total number of neonates produced during the test."

Value BV ROG 11-8-18

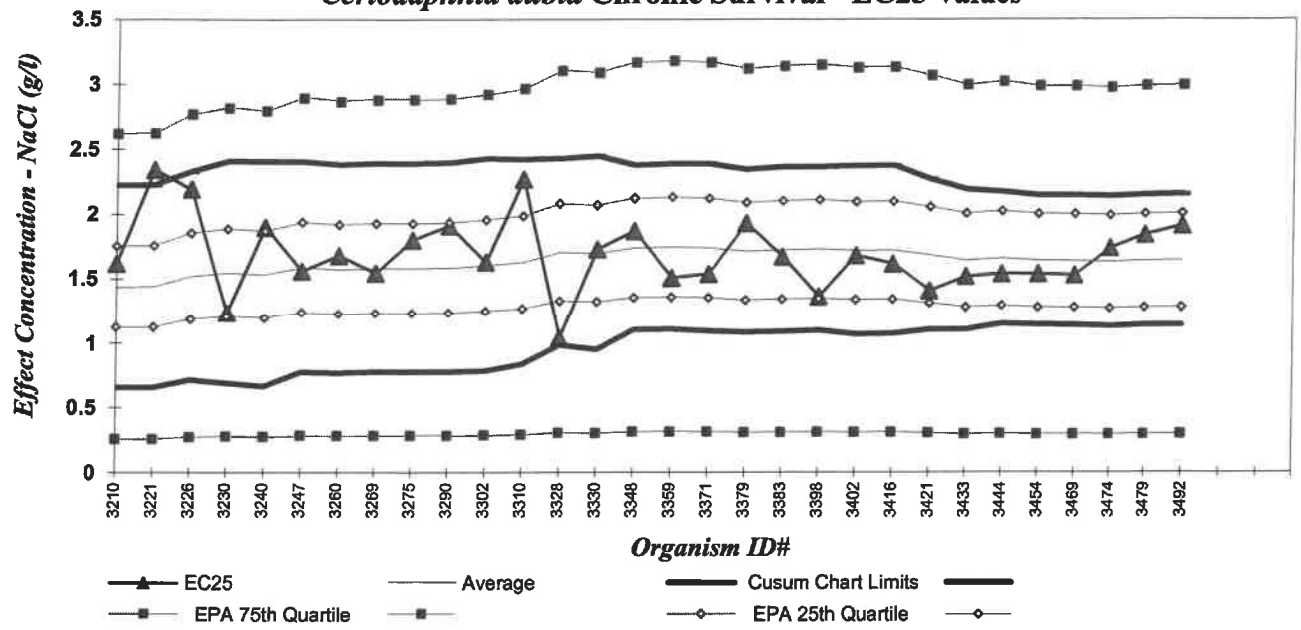
Endpoint	IC25	Cusum Chart Limits
Survival EC_{25}	1.91	1.13 to 2.15
Reproduction	~~0.74~~ IC_{25} 0.92 BV RG 11/9/18	0.22 to 1.25

Task Manager

Project Manager

QA Officer 11-9-18

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART
Ceriodaphnia dubia Chronic Survival - EC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.07

25th Quartile CV (*warning limit*) = 0.11

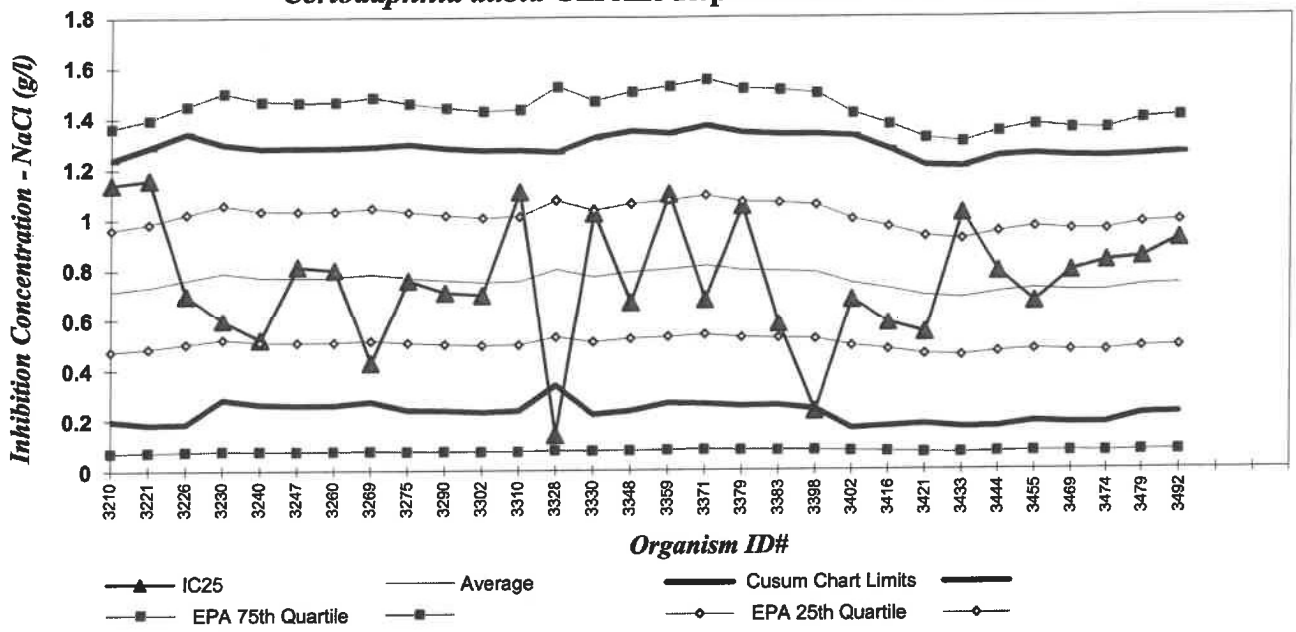
75th Quartile CV (warning *limit*) = 0.41

90th Quartile CV (*control limit*) = 0.81

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	Cerio ID #	Test Start Date	EC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
323	3398	02/06/18	1.36	1.73	0.32	**1.10**	**2.36**	0.19
324	3402	02/27/18	1.68	1.72	0.33	**1.06**	**2.37**	0.19
325	3416	04/10/18	1.62	1.72	0.33	**1.07**	**2.37**	0.17
326	3421	05/01/18	1.41	1.68	0.29	**1.10**	**2.27**	0.17
327	3433	06/05/18	1.52	1.64	0.27	**1.10**	**2.19**	0.15
328	3444	07/10/18	1.54	1.66	0.26	**1.15**	**2.17**	0.15
329	3454	08/07/18	1.54	1.64	0.25	**1.14**	**2.14**	0.15
330	3469	09/07/18	1.53	1.64	0.25	**1.14**	**2.14**	0.15
331	3474	09/20/18	1.74	1.63	0.25	**1.13**	**2.14**	0.15
332	3479	10/04/18	1.84	1.64	0.25	**1.14**	**2.15**	0.15
333	3492	10/30/18	1.91	1.64	0.25	**1.13**	**2.15**	0.15
334								
335								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART
Ceriodaphnia dubia Chronic Reproduction - IC25 Values



Ceriodaphnia dubia - Chronic (EPA Test Method 1002.0)

SODIUM CHLORIDE (g/L)

Endpoint: Chronic Reproduction

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.08

25th Quartile CV (*warning limit*) = 0.17

75th Quartile CV (warning *limit*) = 0.45

90th Quartile CV (*control limit*) = 0.62

Intralab CV is compared to EPA ***Warning limits*** *(25th and 75th CV's) and* ***Control limits*** *(10th and 90th CV's).*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	Cerio ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
323	3398	2/6/2018	0.23	0.79	0.27	0.24	1.33	0.39
324	3402	2/27/2018	0.68	0.75	0.29	0.16	1.33	0.38
325	3416	4/10/2018	0.58	0.72	0.28	0.17	1.27	0.37
326	3421	5/1/2018	0.54	0.69	0.26	0.18	1.21	0.38
327	3433	6/5/2018	1.02	0.69	0.26	0.17	1.21	0.38
328	3444	7/10/2018	0.79	0.71	0.27	0.17	1.25	0.37
329	3455	8/7/2018	0.67	0.72	0.27	0.19	1.25	0.37
330	3469	9/7/2018	0.79	0.71	0.27	0.18	1.24	0.37
331	3474	9/20/2018	0.83	0.71	0.27	0.18	1.24	0.35
332	3479	10/4/2018	0.84	0.73	0.26	0.22	1.25	0.35
333	3492	10/30/2018	0.92	0.74	0.26	0.22	1.25	0.35
334								
335								

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FATHEAD MINNOW 7-DAY SURVIVAL AND WATER QUALITY DATA

Random Template Used: 6 conc. x 4 reps. # 4
Stock Sol. ID 2B071 - 02
Organism ID: FHM 2017

Waterbath/incubator Used: # 7

Date Initiated 11/6/2018 Time 15:35
Date Terminated 11/13/2018 Time 12:45

Test Container Size: 800 ml
Solution Volume / rep: 500 ml

Client: QA / QC - RefTox
Sample Description: KCl (50 g/L stock)

Tech: Day 0 MB Day 1 S/BAM Day 2 BAM/MB Day 3 MB/2 Day 4 MB Day 5 BAM Day 6 BAM Day 7 BAM/2
Time: Day 0 1535 Day 1 1500 Day 2 1400 Day 3 1105 Day 4 0900 Day 5 1740 Day 6 1820 Day 7 1215

Conc. or Percent	Day	Number of Live Organisms A	B	C	D	Dissolved O (mg/l) Pre	Post	pH Pre	Post	Temp. (°C) Pre	Therm. ID #	Conductivity (µS) Post (daily)
Control	0	10	10	10	10		7.1		8.3	Post: 24.1	252	294
	1	10	10	10	10	6.2	6.9	7.6	8.3	24.0	252	315
	2	9	10	10	10	5.8	7.5	7.5	8.2	24.6	250	309
	3	9	10	10	10	7.1	7.4	7.9	8.2	24.5	250	315
	4	9	10	10	10	6.4	7.5	7.0	7.6	*	*	291
	5	9	10	10	10	6.3	7.4	7.4	7.8	24.5	250	308
	6	9	10	10	10	6.1	7.5	7.7	7.9	24.3	250	311
	7	9	10	10	10	6.2		7.7		24.4	250	
0.25 g/L	0	10	10	10	10		7.3		8.3	Post: 24.5		745
	1	10	10	10	10	6.3	7.1	7.6	8.1	24.1		780
	2	10	10	10	10	6.1	7.5	7.7	8.3	24.4		736
	3	9	10	10	10	7.2	7.6	7.9	8.2	24.3		718
	4	9	10	10	10	6.5	7.4	7.0	7.6	*		688
	5	9	10	10	10	6.3	7.5	7.6	7.9	24.6		710
	6	9	10	10	10	6.2	7.7	7.6	8.1	24.3		732
	7	9	9	10	10	6.5		7.7		24.5		
0.50 g/L (11-7-18 R06 BAM)	0	10	10	10	10		7.3		8.4	Post: 24.6		1204
	1	10✓	10✓	10✓	10✓	6.3	7.2	7.6	8.1	24.0		1136
	2	9	10	9	10	6.2	7.6	7.7	8.3	24.4		1141
	3	9	10	9	10	6.9	7.6	7.8	8.2	24.3		1119
	4	9	10	9	10	6.5	7.5	7.1	7.6	*		1110
	5	9	10	9	9	6.4	7.5	7.6	7.9	24.4		1120
	6	9	10	9	9	6.3	7.8	7.6	8.1	24.2		1155
	7	8	10	9	9	6.8		7.7		24.3		
1.0 g/L	0	10	10	10	10		7.4		8.4	Post: 24.6		2020
	1	7	3	3	1	6.2	7.4	7.8	8.2	24.1		1574
	2	5	2	3	0	6.2	7.7	7.9	8.4	24.4		1988
	3	6	1	3		6.7	7.7	7.8	8.2	24.3		1852
	4	5	1	3		6.5	7.7	7.1	7.7	*		1842
	5	1	1	2		6.4	7.6	7.7	8.0	24.2		1880
	6	1	1	2		6.3	7.8	7.9	8.1	24.3		1970
	7	1	1	0		7.1		7.8		24.4		
2.0 g/L	0	10	10	10	10		7.4		8.4	Post: 24.6		3640
	1	0	0	0	0	6.4		7.7		24.1		
	2											
	3											
	4											
	5											
	6											
	7											
4.0 g/L	0	10	10	10	10		7.5		8.4	Post: 24.5		6570
	1	0	0	0	0	6.4		7.7		24.0		
	2											
	3											
	4											
	5											
	6											
	7											

* test temp due to analyst error 1 of 11-16-18

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.
"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.
"F" = fungus noted on dead organisms.

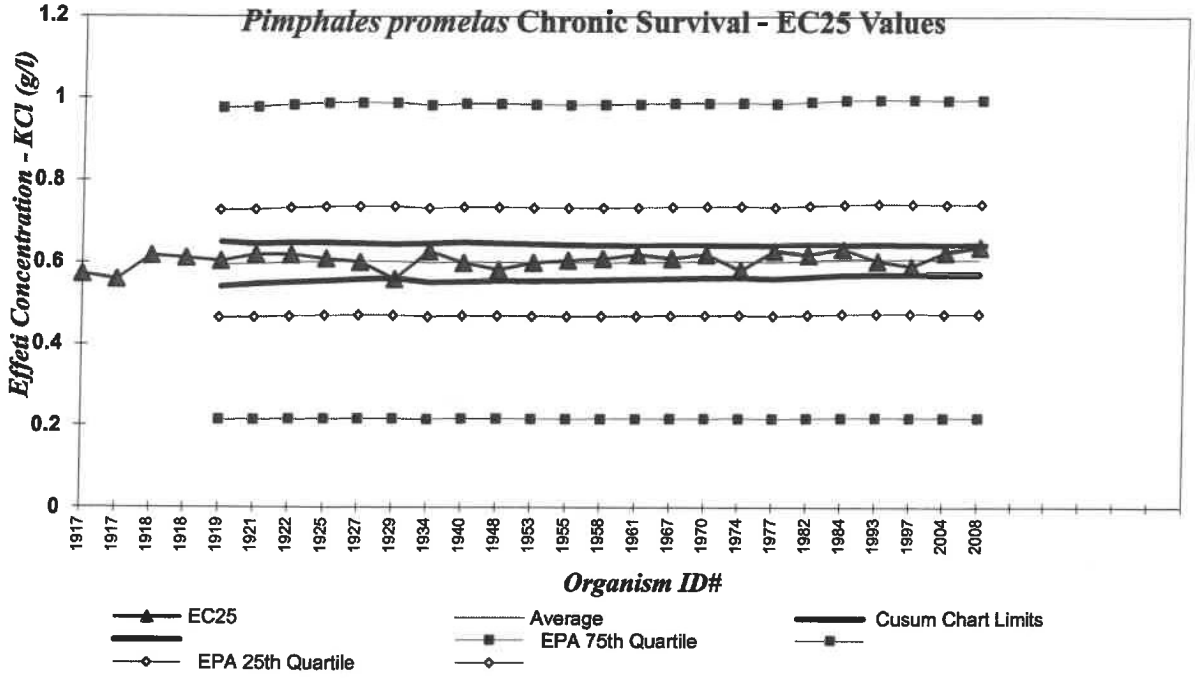
Day 0 Temperatures = Post-renewals
Therm ID# = Thermometer ID used for all measurements that day.
Pre =Pre-renewal solutions. Post =Post-renewal solutions.
(23.8) = Temp. out of recommended range

Endpoint

		Cusum Chart Limits	
Survival - EC_{25}	0.59	0.57	to 0.65
Growth - IC_{25}	0.58	0.44	to 0.72

Task Manager
Project Manager
QA Officer Kathy McKenzie

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



***Pimephales promelas* - Chronic (EPA Test Method 1000.0)**

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Survival

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.03

25th Quartile CV (*warning limit*) = 0.11

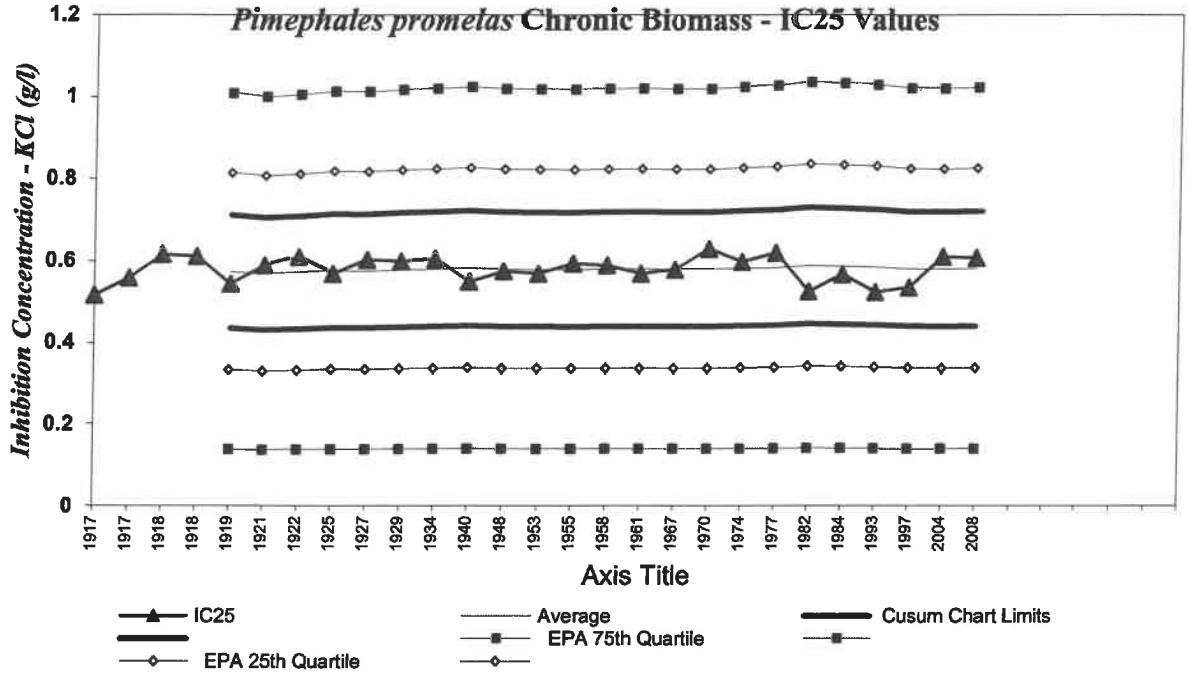
75th Quartile CV (*warning limit*) = 0.32

90th Quartile CV (*control limit*) = 0.52

*Intralab CV is compared to EPA **Warning limits** (25th and 75th CV's) and **Control limits** (10th and 90th CV's), If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.*

Event #	FHM ID #	Test Start Date	EC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
19	1967	02/06/18	**0.61**	0.6	0.02	**0.56**	**0.64**	0.03
20	1970	02/27/18	**0.62**	0.6	0.02	**0.56**	**0.64**	0.03
21	1974	03/20/18	**0.58**	0.6	0.02	**0.56**	**0.64**	0.03
22	1977	04/03/18	**0.63**	0.6	0.02	**0.56**	**0.64**	0.03
23	1982	05/02/18	**0.62**	0.6	0.02	**0.57**	**0.64**	0.03
24	1984	06/19/18	**0.63**	0.6	0.02	**0.57**	**0.64**	0.03
25	1993	07/10/18	**0.61**	0.6	0.02	**0.57**	**0.64**	0.03
26	1997	08/01/18	**0.59**	0.6	0.02	**0.57**	**0.64**	0.03
27	2004	9/6/2018	**0.63**	0.6	0.02	**0.57**	**0.64**	0.03
28	2008	10/2/2018	**0.638**	0.6	0.02	**0.571**	**0.644**	0.03
29	2009	10/4/2018	**0.63**	0.6	0.02	**0.57**	**0.65**	0.03
30	2017	11/6/2018	**0.59**	0.6	0.02	**0.57**	**0.65**	0.03
31								
32								
33								

REFERENCE TOXICANT CUMLATIVE SUMMARY (CUSUM) CHART



***Pimephales promelas* - Chronic (EPA Test Method 1000.0)**

POTASSIUM CHLORIDE (g/L)

Endpoint: Chronic Growth (Biomass)

Stats Method: Linear Interpolation

Test Conditions: Recon MH, 25 oC

From EPA 833-R-00-003:

10th Quartile CV (*control limit*) = 0.12

25th Quartile CV (*warning limit*) = 0.21

75th Quartile CV (*warning limit*) = 0.38

90th Quartile CV (*control limit*) = 0.45

*Intralab CV is compared to EPA **Warning limits** (25th and 75th CV's) and **Control limits** (10th and 90th CV's).*

If lab CV is outside EPA Control limits, the EPA Control limits are used to set Cusum chart limits.

Event #	FHM ID #	Test Start Date	IC25	Running Average	Running SD	Cusum Chart Limits AVG-2SD	Cusum Chart Limits AVG+2SD	Intralab CV
18	1961	01/17/18	**0.57**	0.58	0.03	**0.44**	**0.72**	0.05
19	1967	02/06/18	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
20	1970	02/27/18	**0.63**	0.58	0.03	**0.44**	**0.72**	0.05
21	1974	03/20/18	**0.60**	0.58	0.03	**0.44**	**0.72**	0.05
22	1977	04/03/18	**0.62**	0.58	0.03	**0.44**	**0.72**	0.04
23	1982	05/02/18	**0.53**	0.59	0.02	**0.45**	**0.73**	0.05
24	1984	06/19/18	**0.57**	0.59	0.03	**0.45**	**0.73**	0.05
25	1993	07/10/18	**0.53**	0.59	0.03	**0.44**	**0.73**	0.05
26	1997	08/01/18	**0.54**	0.58	0.03	**0.44**	**0.72**	0.05
27	2004	9/6/2018	**0.61**	0.58	0.03	**0.44**	**0.72**	0.05
28	2008	10/2/2018	**0.61**	0.58	0.03	**0.44**	**0.72**	0.05
29	2009	10/4/2018	**0.62**	0.58	0.03	**0.44**	**0.72**	0.05
30	2017	11/6/2018	**0.58**	0.58	0.03	**0.44**	**0.72**	0.05
31								

APPENDIX C

CHAIN OF CUSTODY

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B 4141-01

Client/Project: Energy NW

Date Received: 11-6-18

Received By: BW

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6°C) Therm ID: 173 Expires: 1116/20K Observed: 1.9 °C, Actual Temp: 4.5 °C	☒ Yes	☐ No	☐ N/A	
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out? (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	

Method of Shipment: ☐ Hand Delivered, ☐ FedEx, ☒ UPS, ☐ Greyhound, ☐ Other: _____ ☐ N/A

AARON HILL
(509) 377-4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

77 LBS

1 OF 1

AH

ceptions were noted)

SHIP TO:
BRETT MUCKEY
(541) 243-6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330-4741

H

OR 973 1-01

Client w

Resolut

UPS NEXT DAY AIR **1**

TRACKING #: 1Z 69V 404 01 5429 7318

BILLING: P/P

REF 1:LePAGE

WS 20.0.20 Zebra ZP 450 06.0A 10/2018

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352
Contact Person: Jane LePage
Phone: 509-377-4061
Project #: Contract 344765

NPDES#: WA002515-1
Composite Sample Information:
Samples/Hour:
Total Hours:
Initiated: Date: Time:
Ended: Date: 110518 Time: 0530
Chilled During Collection: Y

Volume/Sample: 20L
Total Volume: 20L Grab

Ship Samples to: TestAmerica ASL
PO#:
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
190440-01	110518	0530		X	1	B4141-01		X	X	X														CHRONIC EPA-821-R-02-013
																								and acute 48-hr
																								Static per
																								EPA-821-R-03-012

Sampled By & Title: Jane LePage Env. Scientist	(Please sign and print name) Jane LePage	Date/Time: 110518/0530	Relinquished By: Jane LePage	(Please sign and print name) Jane LePage	Date/Time: 110518 1300
Received By	(Please sign and print name)	Date/Time	Relinquished By	(Please sign and print name)	Date/Time
Received By	(Please sign and print name)	Date/Time	Relinquished By	(Please sign and print name)	Date/Time
Received By: Brent Mulkey TA-ASL	(Please sign and print name) Brent Mulkey TA-ASL	Date/Time: 11-6-18 1000	Shipped Via: (UPS) Bis Fed-Ex Hand Other		Shipping #
Work Authorized By	(Please sign and print name)	Remarks: Sample delivered to shipping dept Jane LePage 110518 1300			

COC_Bioassay.xls
Doc Control ID: ASL612-0717

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B41141 - 02
Client/Project: ENW

Date Received: 11-9-18
Received By:

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6°C) Therm ID: 173 Expires: 1/16/2019 Observed: 1.9 °C, Actual Temp: 1.9 °C	☒ Yes	☐ No	☐ N/A	
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out? (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	

Method of Shipment: ☐ Hand Delivered, ☐ FedEx, ☒ UPS, ☐ Greyhound, ☐ Other: _____ ☐ N/A

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352
Contact Person: Jane LePage
Phone: 509-377-4061
Project #: Contract 344763

NPDES#: WA002515-1
Composite Sample Information:
Samples/Hour: Volume/Sample: 20L
Total Hours: Total Volume:
Initiated: Date: Time:
Ended: Date: 110518 Time: 0530
Chilled During Collection: Y

Ship Samples to:
PO#:

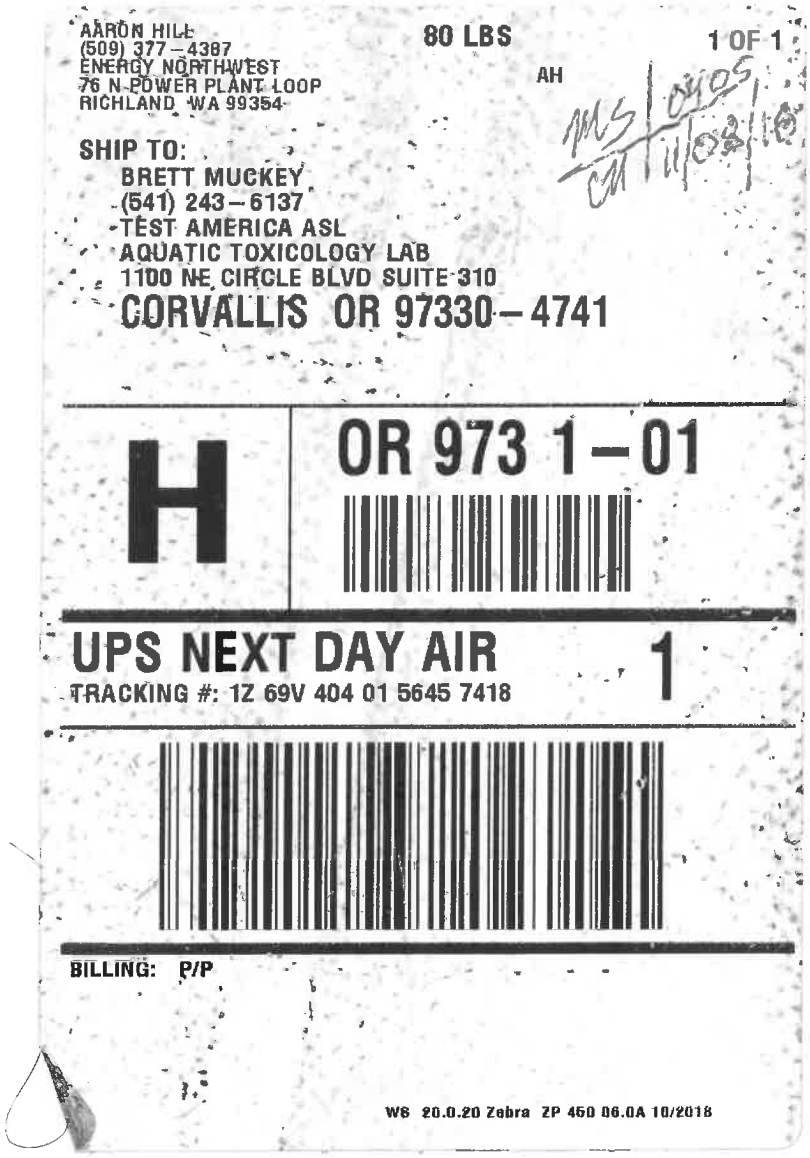
TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
190440-02	110718	0525		X	1	B41141-02		X		X														2nd Sample for
																								EPA-821-R-02-013

Sampled By & Title: Jane LePage Env. Scientist	(Please sign and print name) Jane LePage	Date/Time: 110718 0525	Relinquished By: Jane LePage	(Please sign and print name) Jane LePage	Date/Time: 110718 / 1255
Received By:	(Please sign and print name)	Date/Time: 11-9-18 1050	Relinquished By:	(Please sign and print name)	Date/Time:
Received By:	(Please sign and print name)	Date/Time:	Relinquished By:	(Please sign and print name)	Date/Time:
Received By:	(Please sign and print name)	Date/Time:	Shipped Via: (UPS) Bis Fed-Ex Hand Other		Shipping #:
Work Authorized By:	(Please sign and print name)	Remarks: Cooler delivered to Shipping Dept			



AARON HILL
(509) 377-4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

80 LBS

1 OF 1

AH

MS 0405
CM 11/03/16

SHIP TO:
BRETT MUCKEY
(541) 243-6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330-4741

H

OR 973 1-01

UPS NEXT DAY AIR

1

TRACKING #: 1Z 69V 404 01 5645 7418

BILLING: P/P

WS 20.0.20 Zebra ZP 450 06.0A 10/2018

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Receipt Record

Batch Number: B41141-03 Date Received: 11-16-18

Client/Project: ENW Received By:

Were custody seals intact?	☒ Yes	☐ No	☐ N/A	
Packing Material:	☒ Ice	☐ Blue Ice	☐ Box	
Temp OK? (<6°C) Therm ID: 173 Expires: 1/16/2019 Observed: 1.7 °C, Actual Temp: 1.6 °C	☒ Yes	☐ No	☐ N/A	
Was a Chain of Custody (CoC) Provided?	☒ Yes	☐ No	☐ N/A	
Was the CoC correctly filled out? (If No, document below)	☒ Yes	☐ No	☐ N/A	
Were the sample containers in good condition (not broken or leaking)?	☒ Yes	☐ No	☐ N/A	
Are all samples within 36 hours of collection?	☒ Yes	☐ No	☐ N/A	
Method of Shipment: ☐ Hand Delivered, ☐ FedEx, ☒ UPS, ☐ Greyhound, ☐ Other: _____			☐ N/A	

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD FOR NPDES COMPLIANCE BIOMONITORING

Client: Energy Northwest
Address: PO Box 968
Richland WA 99352
Contact Person: Jane LePage
Phone: 509.377.4061
Project #:

NPDES#: WA002515-1
Composite Sample Information:
Samples/Hour:
Total Hours:
Initiated: Date: Time:
Ended: Date: 110918 Time: 0525
Chilled During Collection: Y

Volume/Sample: 20L
Total Volume: 20L grab

Ship Samples to:
PO#

TestAmerica ASL
Attention: Aquatic Toxicology Laboratory
1100 NE Circle Blvd, Suite 310
Corvallis, OR 97330
Phone: 541.243.6137

Check Chlorine (Y/N):
Temp. Upon Arrival (°C):
Check Ammonia (Y/N): Dechlorinated (Y/N):

Analysis Required / Comments

Sample ID	Date	Time	Sample Type: Comp.	Sample Type: Grab	# of Containers	Lab ID#	Fathead Acute	Fathead Chronic	Cerio Acute	Cerio Chronic	Daphnia Acute	Trout Acute	SHM Acute	SHM Chronic	MB Acute	MB Chronic	MYS Acute	MYS Chronic	Algae	Haz Waste				Concentration and/or Comments
190440-03	110918	5:25 am		✓	1	B4141-03		X		X														3rd Sample for
																								EPA-821-R-02-013

Sampled By & Title: Jane LePage Env. Scientist	(Please sign and print name)	Date/Time: 110918 0525	Relinquished By: Jane LePage (Please sign and print name)	Date/Time: 110918 / 1330
Received By: [signature]	(Please sign and print name)	Date/Time: 11-10-18 1108	Relinquished By	(Please sign and print name)	Date/Time
Received By	(Please sign and print name)	Date/Time	Relinquished By	(Please sign and print name)	Date/Time
Received By	(Please sign and print name)	Date/Time	Shipped Via: (UPS) Bis Fed-Ex Hand Other		Shipping #: 1Z69V404 44555 19022
Work Authorized By	(Please sign and print name)	Remarks: Sealed Cooler delivered to UPS Store, Richland.			

COC_Bioassay.xls
Doc Control ID: ASL612-0717

AARON HILL
(509) 377-4387
ENERGY NORTHWEST
76 N POWER PLANT LOOP
RICHLAND WA 99354

80 LBS

AH

SHIP TO:
BRETT MUCKEY
(541) 243-6137
TEST AMERICA ASL
AQUATIC TOXICOLOGY LAB
1100 NE CIRCLE BLVD SUITE 310
CORVALLIS OR 97330-4741

H

OR 973 1-01

UPS NEXT DAY AIR

TRACKING #: 1Z 69V 404 44 5551 9022

BILLING: P/P

WS 20.0.20 Zebra ZP 450 0

ENCLOSURE C

EPA FORM 2-C SUPPLEMENTAL
COOLING WATER INTAKE STRUCTURE

EPA Form 2-C Supplemental Cooling Water Intake Structures

CWA §316(b) requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. EPA has promulgated rules for new facilities at 40 CFR 125 Subpart I and for existing facilities at 40 CFR 125 Subpart J. This form requests information from applicants using EPA Form 2-C to determine applicability of CWA 316(b) requirements and inform applicants of additional application requirements that may apply to the facility.

Facility Name: Energy Northwest Columbia Generating Station

NPDES Permit Number: WA002515-1

SECTION A. APPLICABILITY

☒ **Yes** ☐ **No** Is there a cooling water intake associated with this facility? Cooling water intake means a structure withdrawing cooling water, for contact or noncontact cooling, from a surface water source. Withdrawal from groundwater or a public water system is not applicable. If No, STOP.

1.	What is the design intake flow (in gallons per day)?	36,000,000 gal/day
2.	What percentage of the flow is used exclusively for cooling?	~90 to 99%
3.	What is the maximum intake velocity?	The intake screens on Cooling Water Intake Structure (CWIS) were designed for low through-screen velocities to minimize impingement and entrainment. At the external screen surface under maximum operating conditions, the velocity through the external screen openings is ~0.5 ft/s. At a distance of less than 1/3" from the outer screen surface, the inlet velocity drops to 0.2 ft/s. During reduced flow, the perforated pipe intake velocity is proportionately reduced. For average intake conditions, the nominal bulk velocity approaching the screens (screen-nominal direction) is 0.07 ft/s and the average normal through-pore velocity is 0.16 ft/s.
4.	Describe the cooling water system (e.g., once-through, closed-cycle).	Closed-cycle Recirculating System. The system typically operates between 5 and 12 cycles. The blowdown rate is 1.91 MGD (2016-18 average).
5.	Name the surface water body from which cooling water is withdrawn.	Columbia River
6.	Provide latitude/longitude of the cooling water intake(s) (NAD83/WGS84). To ensure accurate locations provide at least 5 significant digits.	46.471419 / -119.262954

7.	Describe the configuration of the intake(s) (e.g., dimensions, screen type). If as-built plans and specifications are available, please provide.	Dual intake screened cylinders. Each cylinder is 30 feet long and is composed of two intake screens each 6.5 ft long. The screens consist of an outer and inner sleeve of perforated pipe. The outer sleeve is 42" diameter with 3/8" holes and the inner sleeve is 36" diameter with ¾" holes. (see attachment for additional information).
8.	When was the intake(s) installed, including any major modifications?	Prior to December 1984 when the plant became operational
9.	When was the intake(s) last inspected? If regular inspections are scheduled, provide frequency.	September 17, 2018. Inspections are conducted every 3 years.
10.	Have there been any studies to determine the impact of the intake(s) on aquatic organisms (e.g., impingement/entrainment studies). Impingement Study (GO2-18-104) submitted to NMFS, Ecology and EFSEC on 9/26/18. Interim Fish Entrainment Study Report (GO2-19-035) submitted to NMFS, Ecology and EFSEC on 2/7/19.	☒ **Yes** ☐ **No** If yes, please provide

SECTION B. APPLICATION REQUIREMENTS

CWA §316(b) requirements apply to all industrial NPDES permitted facilities with cooling water intake structures. EPA has promulgated best technology available (BTA) effluent guidelines for facilities meeting certain thresholds:

- Design intake flow greater than two million gallons per day.
- Greater than 25 percent of the water withdrawn is used for cooling purposes.

Submittal requirements for facilities subject to BTA effluent guidelines:

- New facilities must submit information specified in 40 CFR 122.21(r) and 40 CFR 125.86.
- Existing facilities must submit information specified in 40 CFR 122.21(r) and 40 CFR 125.95. See attachment

Facilities subject to BTA guidelines are encouraged to contact Ecology early in the application process. Ecology may consider this application administratively incomplete until the required information is received.

Submittal requirements for existing facilities and new facilities below BTA thresholds:

- Ecology will evaluate the information submitted with this form and may request additional information to assess the need for requirements under 40 CFR 125.90(b) or 40 CRF 125.80(c).

SECTION C. INSTRUCTIONS

All applicants required to submit EPA Form 2C, available here: www.ecy.wa.gov/programs/wq/permits/forms.html must also submit this supplemental form to determine the applicability of CWA §316(b) and any additional application requirements. Enter all applicable information and submit this form as an attachment to Form 2C.

APPLICABILITY

CWA §316(b) requirements apply only to point sources (facilities that have or are required to have an NPDES permit) withdrawing cooling water from waters of the U.S. (surface waters). Withdrawal from groundwater, a public water system, or the use of treated effluent that would otherwise be discharged to waters of the state does not constitute use of a cooling water intake structure. Select Yes or No to the first question. If you answer No, you do not need to complete the remainder of the form.

1. Design intake flow (DIF) means the value assigned during the facility's design representing the maximum instantaneous rate of flow of water the cooling water intake system is capable of withdrawing from a source waterbody. Existing facilities may adjust this value to reflect any permanent changes to the maximum capabilities of the intake system including but not limited to permanent removal of pumps, flow limit devices, and physical

limitations of piping. DIF doesn't include emergency capacity or redundant pumps. Report this value in gallons per day (gpd).

2. Report the percentage of water withdrawn that is used exclusively for cooling purposes, measured on an average monthly (new facilities) or average annual over the past three years (existing facilities) basis. Cooling water that is used in a manufacturing process either before or after it is used for cooling is not considered cooling water for the purposes of calculating this percentage.
3. Provide the maximum actual or design intake velocity as water passes through the structural components of the intake screen, measured perpendicular to the screen mesh. Report this value in feet per second (fps). Indicate which value is reported, design or actual.
4. Describe the cooling water system, including if the water is used once (once-through) or recirculated (closed-cycle). If recirculated, provide the minimum number of cycles the water is recirculated and average blowdown flow in gpd.
5. Provide the name of the surface water body your intake structure withdraws water from (e.g., ABC river)
6. Provide an accurate location for each intake structure associated with the facility.
7. Describe the cooling water system including a description of the intake screen dimensions, perforation sizes (if known), and screen type (e.g., traveling screens, wedgewire, barrier nets, trash racks). Provide any design drawings and specifications available.
8. Give the date the intake was first installed and the date(s) of any major modifications to the structure(s).
9. Provide the date of last intake inspection and the frequency of any regularly scheduled inspections.
10. Please provide any available studies of the impact to aquatic life from your cooling water intake structure. These may include studies of entrainment and impingement of fish and shellfish.

APPLICATION REQUIREMENTS

Facilities with design intake flows greater than two million gallons per day, of which greater than 25 percent of the water withdrawn is used exclusively for cooling purposes, must comply with applicable application requirements in federal rule. Please refer directly to the applicable rules, cited in Section B. to determine requirements specific to your facility. Existing facilities should also contact their permit manager for technical assistance. New facility applicants should contact their regional office permit coordinator (www.ecy.wa.gov/programs/wq/permits/permit_coord.html) for assistance.

All applicants are encouraged to provide thorough answers to the questions on this form, along with any additional information that may be useful in determining applicability and application requirements. Ecology may request additional information from facilities with cooling water intake structures operating below the design intake and percentage flow thresholds. Ecology will use the information provided to make a case-by-case determination of the need for additional requirements per 40 CFR 125.80(c) and 40 CFR 125.90(b).

For special accommodations or documents in alternate format, call the Water Quality Program at 360-407-6600. Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.

Columbia Generation Station § 316(B)

Addendum to EPA Form 2-C Supplemental Cooling Water Intake Structure in adherence with §122.21(R)(2), (3), (4), (5), (6), (7) and (8)

Energy Northwest
Environmental and Regulatory Programs
April 2019

1. Introduction

This document contains summary information to support §122.21(r) permit application requirements for Columbia Generating Station (CGS) located in Richland, WA. The §122.21(r) studies are submitted in compliance with U.S. Environmental Protection Agency (EPA) final §316(b) regulations (Rule) for existing facilities. The Rule became effective on October 14, 2014. The Rule applies to owners and operators of existing facilities that meet all following criteria:

- The facility is a point source that uses cooling water from one or more cooling water intake structures that withdraws water from waters of the United States and provides cooling water to the facility by any sort of contract or other arrangement;

- The facility-wide design intake flow (DIF) for all cooling water intake structures at the facility is greater than 2 Million Gallons per Day (MGD);

- The cooling water intake structure withdraws cooling water from waters of the United States; and

- At least 25 percent of the water actually withdrawn – actual intake flow (AIF) – is used exclusively for cooling purposes.

CGS meets all of these requirements. The Rule requires all facilities using greater than 2 MGD to install best technology available ("BTA") to reduce entrainment and impingement mortality. Existing facilities, such as CGS, with a DIF greater than 2 MGD but actual intake flow (AIF) less than 125 MGD are required to meet the impingement mortality standards of § 125.94(c) and site-specific entrainment requirements under the entrainment standards of § 125.94(d). Facilities with an AIF less than 125 MGD are required to submit the §122.21(r)(2) and (3) information and applicable provisions of the (r)(4) through (8) that includes:

(r)(2) – Source Water Physical Data
(r)(3) – Cooling Water Intake Structure Data
(r)(4) – Source Water Baseline Biological Characterization Data
(r)(5) – Cooling Water System Data
(r)(6) – Chosen Method of Compliance with the Impingement Mortality Standard
(r)(7)—Entrainment Performance Studies
(r)(8) – Operational Status

Information presented on the following pages includes summarized data from numerous recently prepared and historic documents that detail CGS design, operation, licensing and studies related to fish impingement and entrainment performance and risk. This summary report has been prepared to meet the requirements of §122.21(r) and section B of EPA Form 2-C Supplemental for Cooling Water Intake Structure. This form is to accompany the CGS National Pollutant Discharge Elimination System (NPDES) Permit renewal application.

2. 40 CFR 122.21(r)(2) Source water physical data

40 CFR 122.21(r)(2) requires Energy Northwest to provide the following source waterbody physical data for CGS:

(i) A narrative description and scaled drawings showing the physical configuration of all source water bodies used by your facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located;

(ii) Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods you used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies; and

(iii) Locational maps.

The following source water physical data are provided to characterize the source waterbody in the vicinity of CGS. The following sections describe the Columbia River's dimensions, key physical and water characteristics, and provides figures and maps required under 40 CFR 122.21(r)(2).

2.1 Narrative description of source water

The Columbia River is the source of non-contact cooling water for CGS, which is owned and operated by Energy Northwest. The river travels more than 1,200 miles from its origin in the Canadian Rocky Mountains and occupies a watershed area of 262,000 square miles. There are three geographic regions of the river, including the headwaters, the semi-arid basin, and the coastal rain forest. The Columbia River terminates in the Pacific Ocean near Astoria, Washington. CGS draws water from the Hanford Reach, which is located in the semi-arid basin. The Columbia River is the largest river in North America that discharges into the Pacific Ocean and is primarily fed by snowmelt runoff in the Canadian Rockies, as well as downstream tributaries, such as the Snake and Yakima rivers (Energy Northwest 2010). The entire run of the Columbia River is shown in Figure 2-1.

The Hanford Reach describes the 51-mile stretch of the Columbia River that is unobstructed and flows freely. The reach begins at the tailrace of the Priest Rapids Dam and ends at the McNary Dam pool. The river elevation in this stretch drops approximately 70 feet (Energy Northwest 2010). The river tends to meander within the reach and braided islands are common – for example, Homestead Island splits the river into two channels, east and west, and occurs directly to the east of the Tower Makeup Pumphouse (TMU) used by CGS to withdraw water. The banks of the northern reach are protected either by National Monument status or as a function of being on the Hanford Nuclear Reservation.

Water from the Columbia River is used in irrigation, domestic purposes, hydropower generation, fisheries, transportation, recreation, and industry. It also provides habitat for pacific salmonid migration (Energy Northwest 2010).

Figure 2-1: Columbia River watershed with Columbia River highlighted (Wikimedia 2008)

2.2 Aerial dimensions

CGS is located downstream from the Priest Rapids Dam and approximately 10 miles north of Richland, Washington (Figures 2-2 to 2-4). The river exhibits some braided features in the area and runs north-south. The river width varies from 1,000 to 3,300 feet in the Hanford reach and discharges to the south (Energy Northwest 2010).

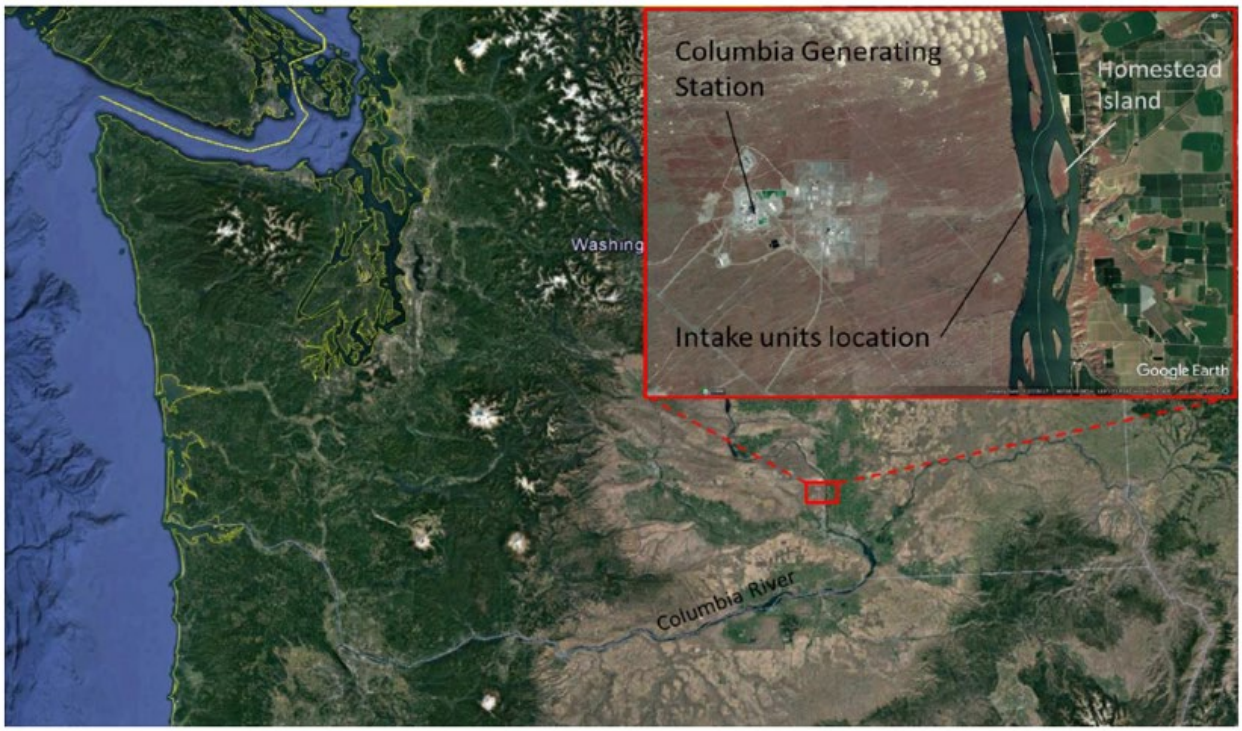


Figure 2-2: Location of CGS in Washington State (Alden 2018)

Figure 2-3: Location of CGS relative to a 50-mile radius (Energy Northwest 2010)

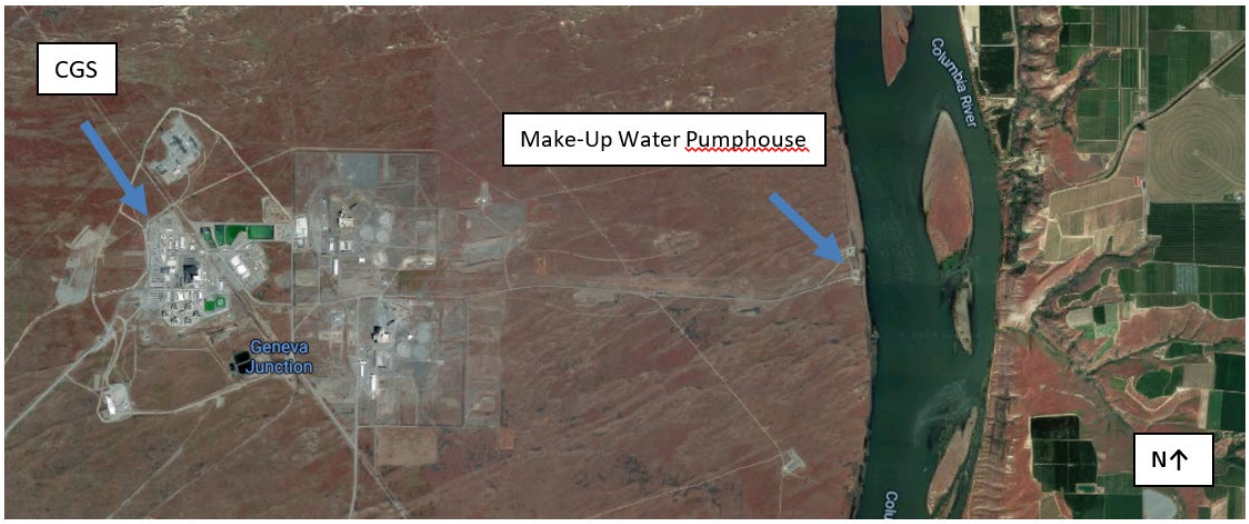


Figure 2-4: Aerial View of CGS and the Columbia River (Google Maps 2019)

2.3 Water depths

Flow in the Hanford Reach of the Columbia River varies seasonally, but is usually highest during April through July run-off events and lowest in September and October. Figures 2-5 and 2-6 are maps produced by Pacific Northwest National Laboratory (PNNL) which display the depth of the Columbia River nearest to the pumphouse over varying states of discharge (Anchor 2019). The mean discharge through Priest Rapids Dam from 1984 to 2008 was 114,410 cubic feet per second (ft^3/s) (Energy Northwest 2010). Based on the maps and discharge data, depth can be estimated with a range of approximately 16 to 20 feet, with late fall and winter likely dropping below 16 feet. Water elevations near the pumphouse range from an extreme high of approximately 373 feet above mean sea level to an extreme low of 342 feet above mean sea level (Anchor 2019).

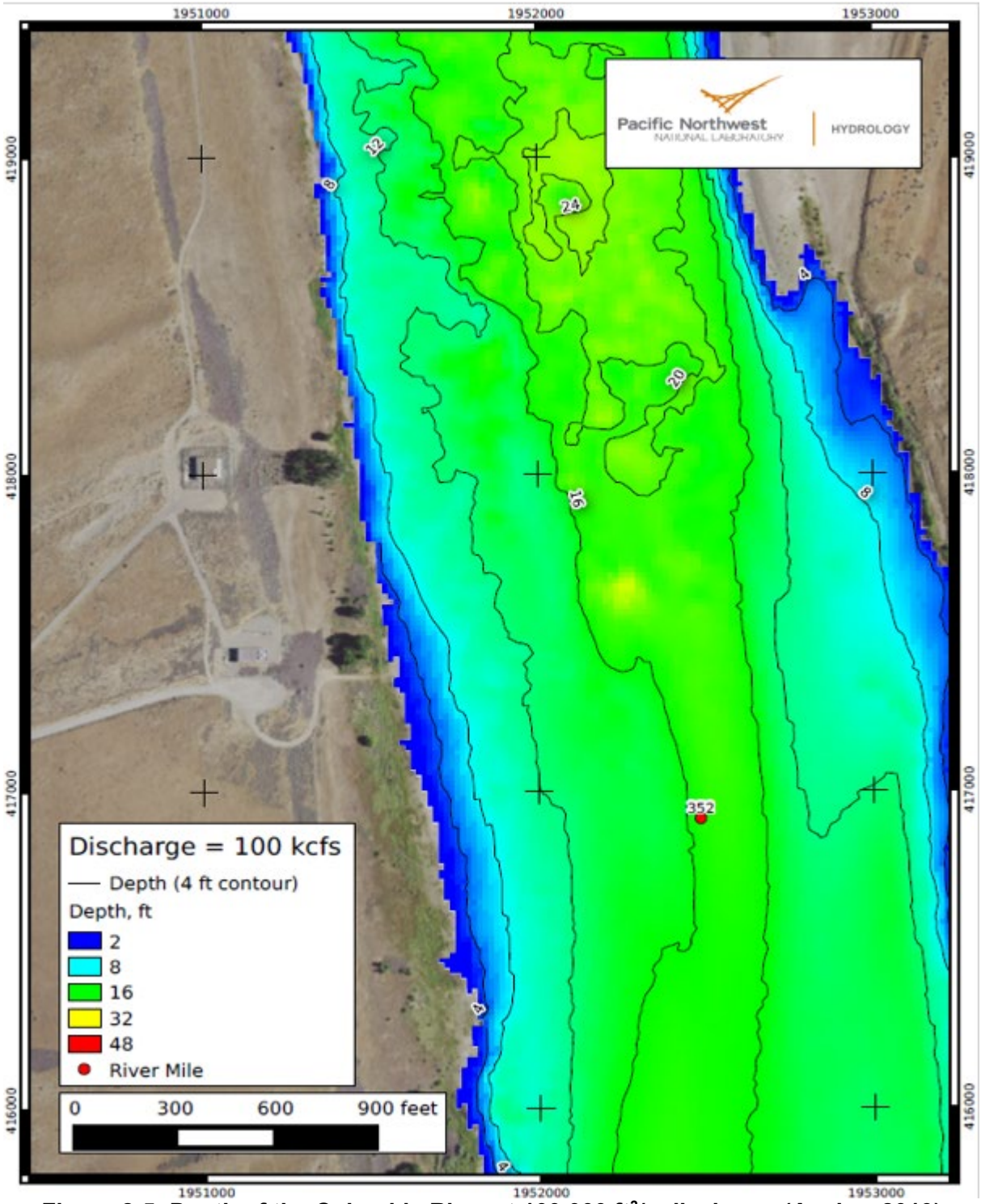


Figure 2-5: Depth of the Columbia River at 100,000 ft^3/s discharge (Anchor 2019)

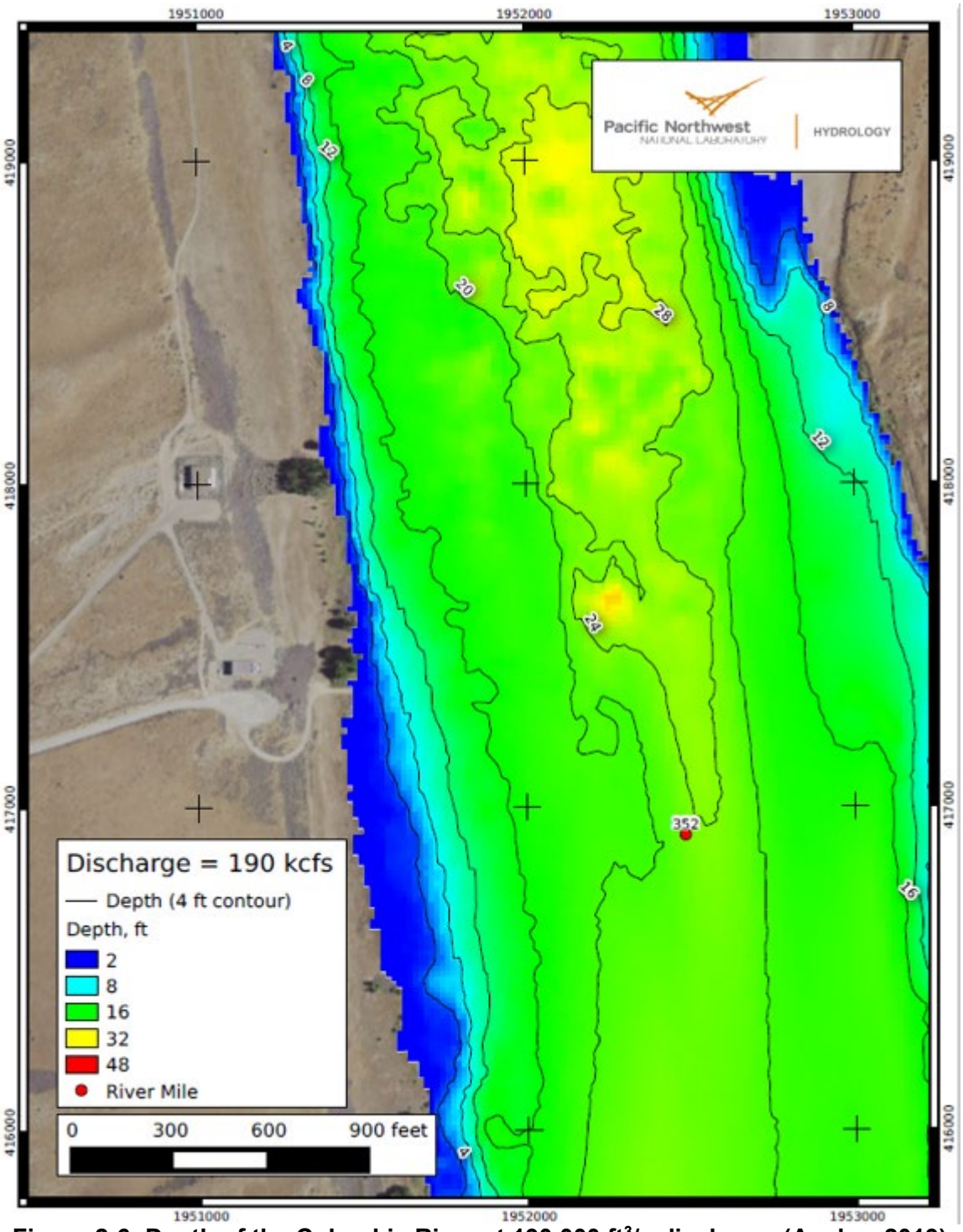


Figure 2-6: Depth of the Columbia River at 190,000 ft^3/s discharge (Anchor 2019)

2.4 Temperature Regime

Grant Public Utility District tracks dissolved gas super-saturation measurements for the Priest Rapids Dam Tailrace. Monthly average temperature data was collected from 2014 through 2018 and the mean water temperature was calculated monthly for 5 years.

Table 2-1: Monthly average water temperature in the Columbia River (2014-2018)

Month	Mean (deg. C)
January	4.2
February	3.2
March	4.7
April	7.5
May	11.5
June	15.2
July	18.4
August	20.0
September	18.8
October	16.1
November	12.1
December	7.8

As expected, the Columbia River temperatures follow ambient temperatures through the year and is at its warmest in summer and beginning to decline in fall before reaching its lowest in winter.

2.5 Hydrological & Geomorphological Features

The Hanford Reach of the Columbia River in the vicinity of CGS is typical of the Columbia Basin; the width-to-depth morphology is high, the gradient is low, and the bed of the river is primarily sand. The large islands that are braided through the main channel are frequently inundated and modify river flow and velocity (Alden 2018). Flow is controlled by the amount of water discharged by Priest Rapids Dam, and meanders roughly north-to-south in the Hanford Reach before bending to the west and towards the pacific downstream at Wallula Gap.

The intake structures are raised slightly above the riverbed in the main channel and are double-screened parallel to the direction of flow. The ends of the intakes are capped and water can only enter through the side perforations. Water is gravitationally fed from the Cooling Water Intake Structure (CWIS) to the pumphouse well at the TMU. There is no direct pumping from the Columbia River. At low water, the structures are approximately 350 feet offshore (EFSEC 2014). Figure 2-7 is a qualitative description of the intake structure function.

The Area of Influence (AOI) of the water intake structures was modeled using Computational Fluid Dynamics (CFD) Analysis by Alden Research Laboratory for an Impingement Study Report. The study found the CWIS influence of operation is remarkably similar or with only limited increase in risk of impingement in both On and Off conditions (Alden 2018). In other words, in the context of sweeping velocity, the circulating water intake screen in operation has little to no more risk of impingement than when the CWIS is not in operation for all models run.

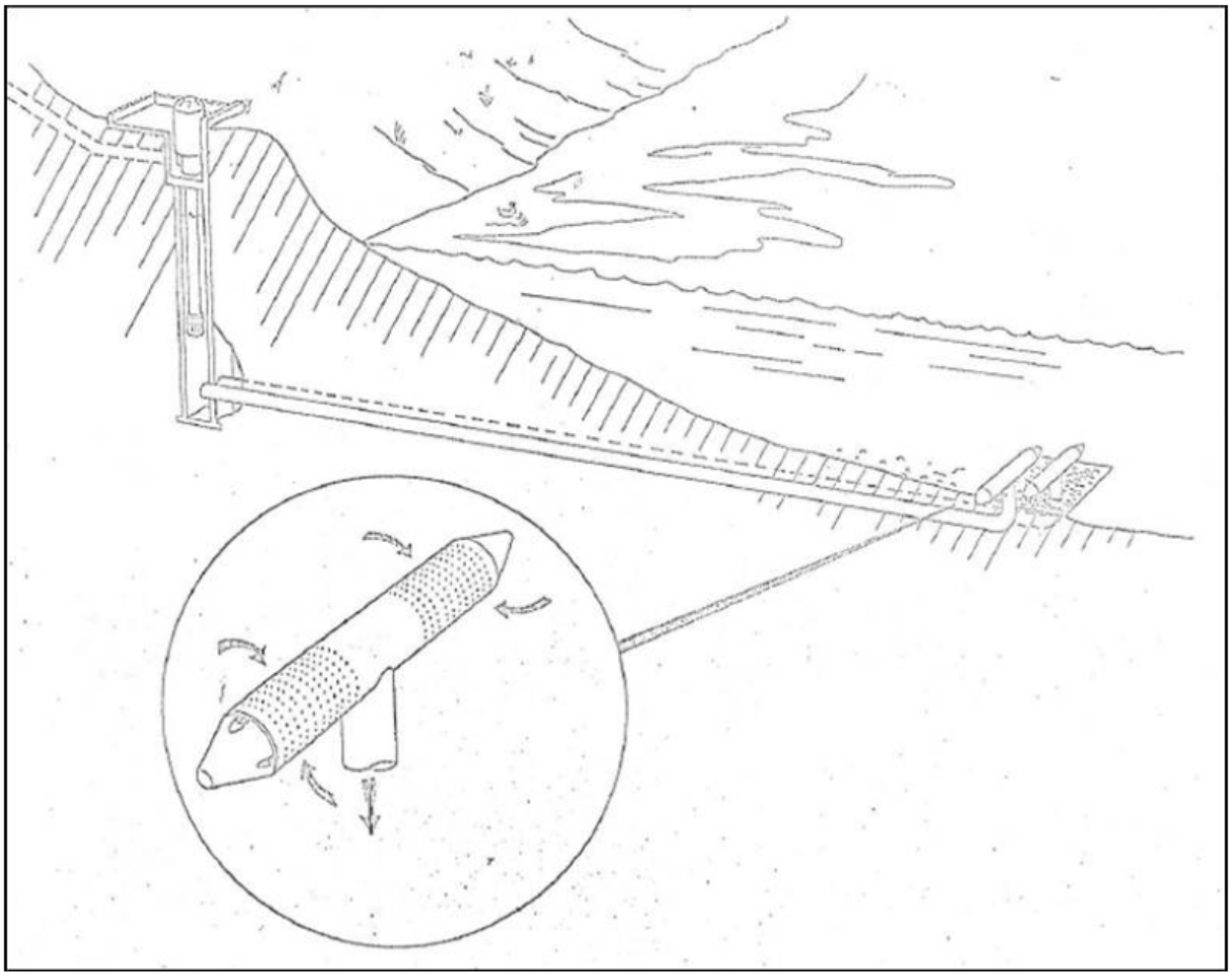


Figure 2-7: Artist rendering of CGS intakes structures (Coutant 2014)

3. 40 CFR 122.21(r)(3) Cooling water intake structure data

40 CFR 122.21(r)(3) requires CGS to provide the following cooling water intake information:

(i) A narrative description of the configuration of each of your cooling water intake structures and where it is located in the water body and in the water column;

(ii) Latitude and longitude in degrees, minutes and seconds for each of your cooling water structures;

(iii) A narrative description of the operation of each of your cooling water intake structures, including design intake flows, daily hours of operation number of days of the year in operation and seasonal changes, if applicable;

(iv) A flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges; and

(v) Engineering drawings of the cooling water intake structure.

The following data are provided to characterize the CGS CWIS and evaluate the potential for impingement and entrainment of aquatic organisms.

3.1 CWIS Configuration

CGS is a single-unit, boiling-water nuclear power plant that began commercial operating in December 1984. The reactor produces heat that boils water, producing steam for direct use in a steam turbine, which generates electricity for the Pacific Northwest grid. Steam that exits the turbine is condensed with cool water from a closed cycle cooling system consisting of six mechanical-draft cooling towers that remove heat from the circulating water and transfer the heat to the atmosphere. A portion of the water in the circuit is lost by evaporation and drift of droplets entrained in air. The evaporation and drift losses lead to concentration of dissolved salts in the cooling circuit, necessitating a gradual replacement of water in the circuit by release of so-called “blowdown” water to the Columbia River. The combined losses from evaporation, drift and blowdown are replenished by so-called “makeup” water pumped from the Columbia River.

The Tower Makeup Pumphouse (TMU) is located 3 miles (5 kilometers) east of the CGS reactor complex and approximately 300 feet (91 meters) shoreward of the river’s normal high-water mark at RM 352 (Figure 3-1). It houses three 800-horsepower makeup water pumps situated in a pump well. The pump well is connected to two CWIS in the river by two 36-inch (91-centimeter) diameter buried pipes that extend 900 feet (274 meters) from the pump house. Columbia River water flows by gravity into the pump well.

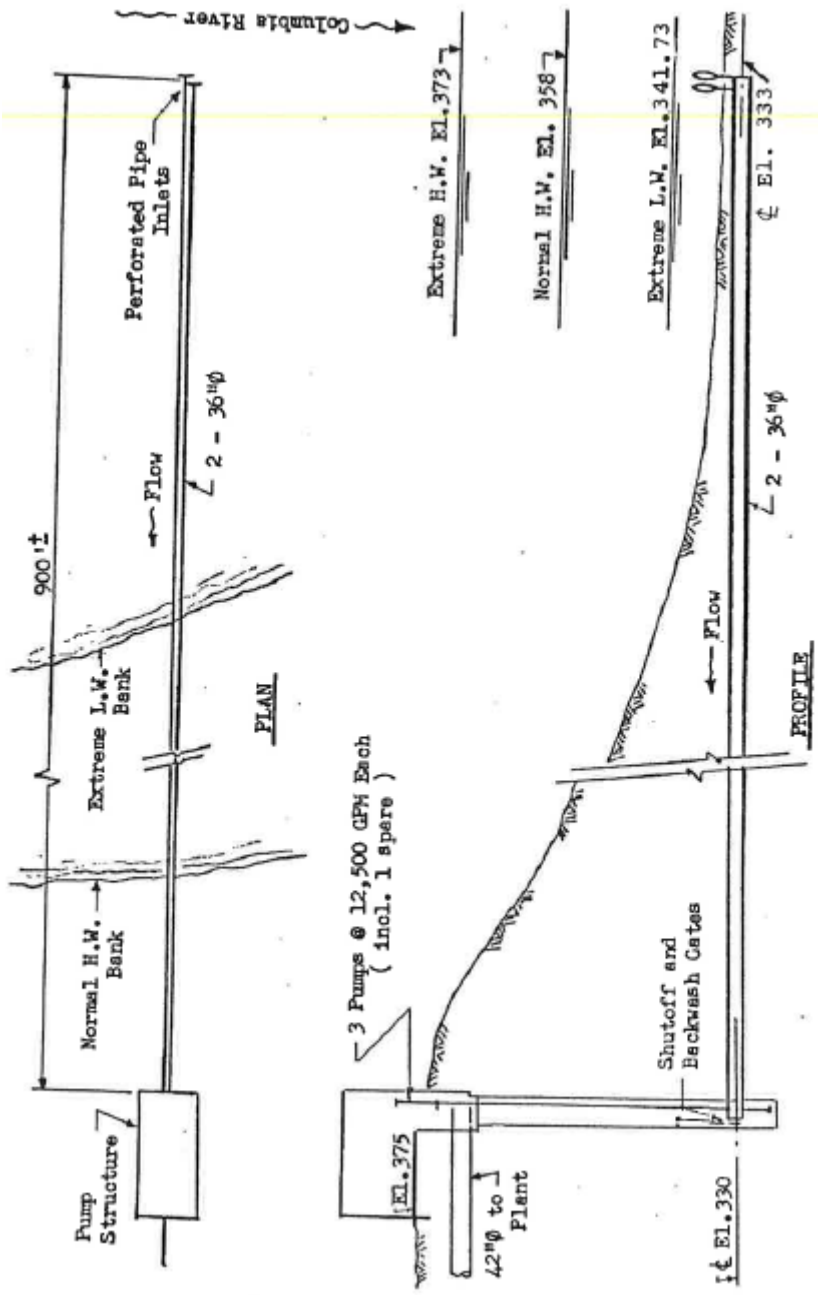


Figure 3-1: CGS Intake sytem plan and profile (Coutant 2014)

The pumps are designed to each supply 12,500 gallons per minute (gpm) (0.79 cubic meters per second [m^3/s] or 9 million gallons per day [MGD]) or half the system capacity at design head. Two pumps can supply makeup water to the plant with a withdrawal capacity of 25,000 gpm (1.58 m^3/s or 36 MGD) but during normal operating periods, the average makeup water withdrawal is approximately 17,000 gpm (1.1 m^3/s or 24.48 MGD). This contrasts with the average mean annual discharge of the Columbia River near the site of 117,823 ft^3/s (3,336 m^3/s or 76.2 billion gallons per day [BGD]) and a minimum mean annual discharge of 80,650 ft^3/s (2,284 m^3/s or 52.1 BGD) (USGS 2010). The average makeup water withdrawal of 17,000 gpm is thus about 0.03 percent of the average mean annual discharge and 0.05 percent of the minimum mean annual discharge of the river.

An intake structure is located at the end of the buried pipes. The pipes make a 90-degree upward bend and extend slightly above the surface of the riverbed (Figures 2-7 and 3-2). The elevation at the top of the CWIS's is approximately 341 feet. The normal high water elevation of the Columbia River is 358 feet and the extreme low water elevation is 342 feet.

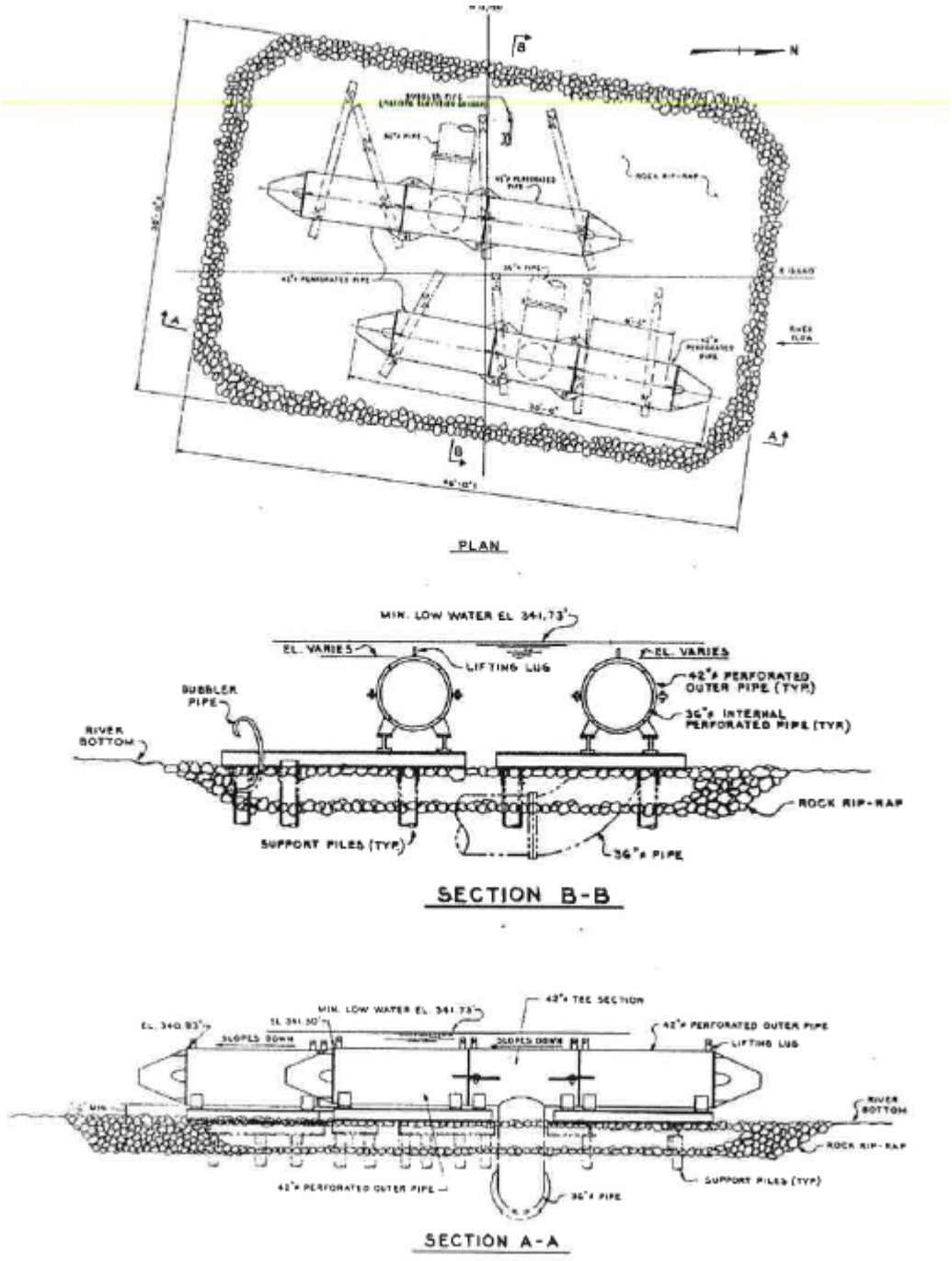


Figure 3-2: Perforated intake plan and section (Coutant 2014)

Attached to each of the pipes is a 30 feet (9 meters)-long, cylindrical screen housing mounted above the riverbed and approximately parallel to the river flow. Each cylinder is composed of two intake screens each 6.5 feet (2 meters) long and mounted upstream and downstream of a central chamber attached to the buried pipe. Solid cones cap each end of the dual-screen structure (Figure 3-3). The screens consist of an outer and inner sleeve of perforated pipe. The outer sleeve (forming the wall of the cylinder is 42-inches in diameter (107 centimeter [cm]) with 3/8-inch (9.5 millimeter [mm]) holes comprising 40 percent of the surface area. The inner sleeve is 36-inches (91-cm) diameter cylinder with ¾-inch (19 mm) holes comprising 7 percent of the surface area. The double-sleeve intake screens are designed to distribute water flow into the structure evenly along its outer surface (Coutant 2014).

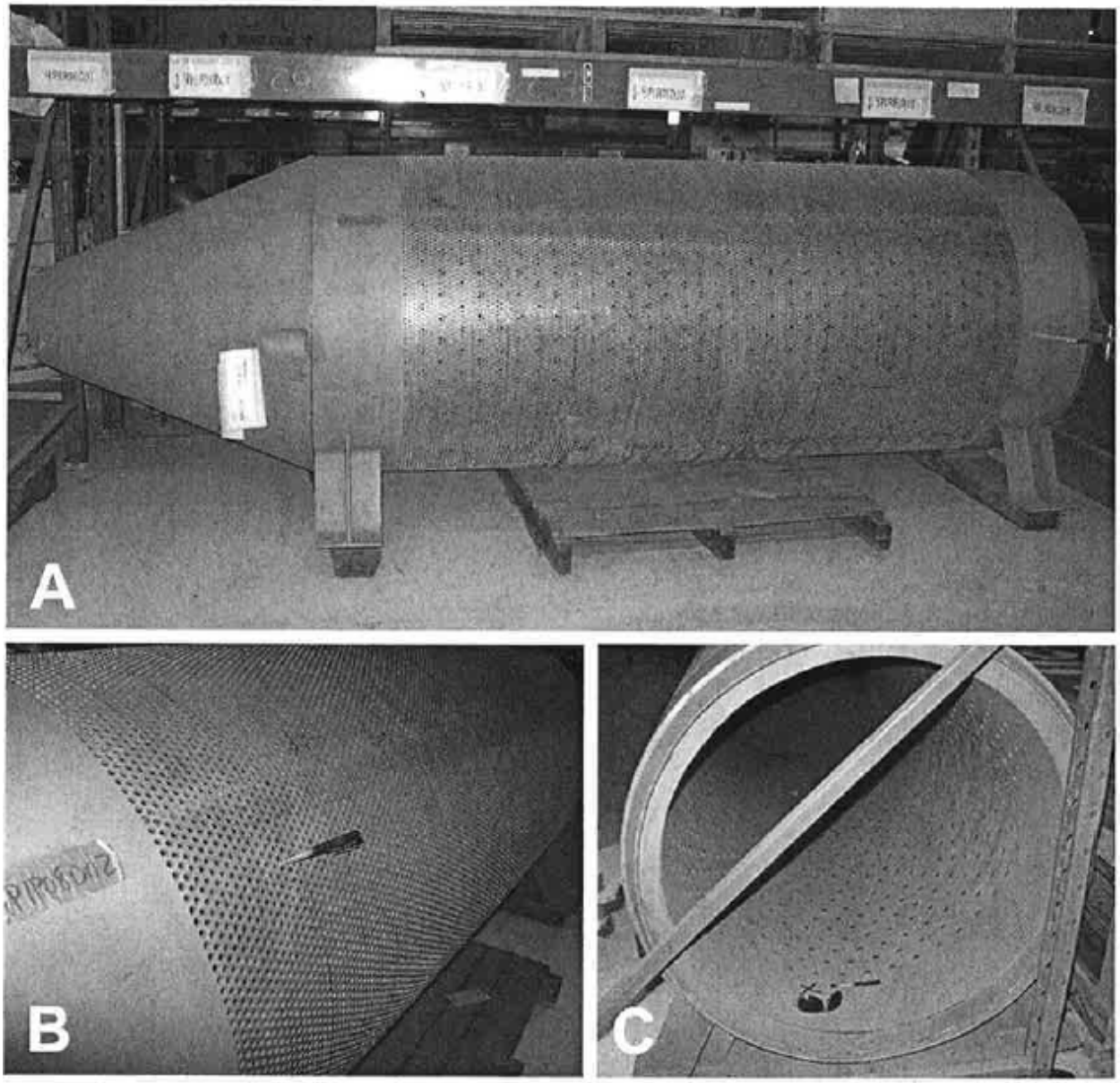


Figure 3-3: Spare perforated pip for the intakes at CGS (Coutant 2014)
(A: side view; B: close up of outer sleeve; C: end view showing inner sleeve of perforated pipe)

The dual intake cylinders are located in the main channel of the Columbia River, which is flowing north to south (Figure 3-4). CGS's CWIS is located at latitude 46.471419 and longitude -119.2629.54.

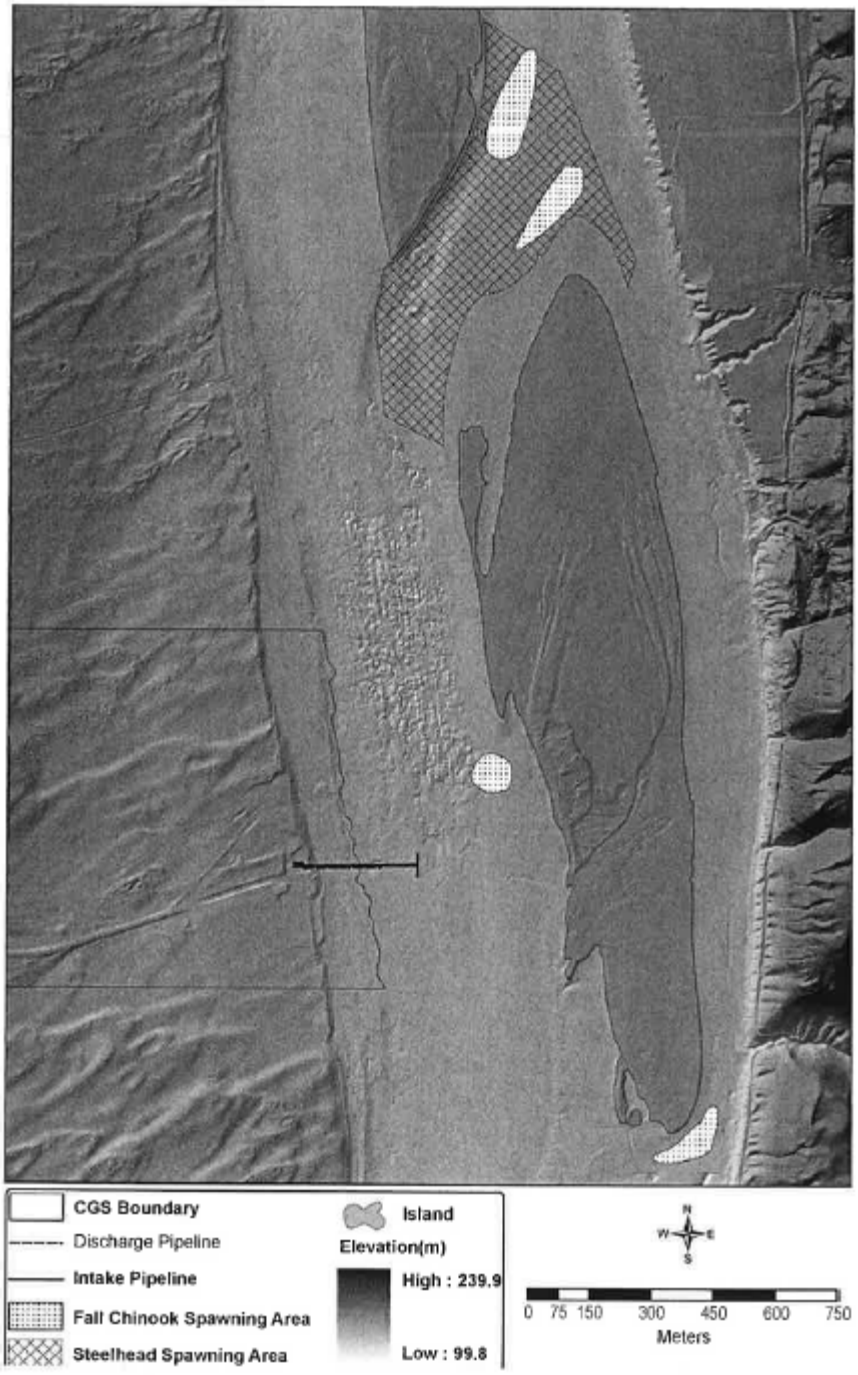


Figure 3-4: Location of pumphouse, pipelines, intakes, and outfalls

3.2 CWIS Operation and Intake Flows

As discussed above, there are three pumps located in the pumphouse. These pumps are used to withdraw water from the pumphouse well. Each pump is rated for 12,500 gpm. Normally,

only two pumps are used to supply makeup water to CGS. The design intake flow (DIF) with the two pumps operating at a maximum rate is 25,000 gpm (55.7 ft^3/s, 36 MGD) (Energy Northwest 2010).

The CWIS typically operates 24-hours per day and for 365-days per year. Every two years CGS is shut down for a refueling and maintenance outage. These outages typically last for approximately 30 to 40 days. During these outages the CWIS structure remains in operation at a reduced rate. Depending on the maintenance schedule, the TMU pumphouse may also be taken out of service.

There is also seasonal variation in the amount of cooling water required by CGS. This variation requires increased makeup water utilization during the summer months. CGS's 2014 through 2018 water intake flow data from the Columbia River is provided in Table 3-1.

Table 3-1: Water intake flow data (2014-2018)

Year	Total Annual Intake from the Columbia River (gal)	Estimated Operating Days (days)	Average Daily Intake Flow			
			(gal/day)	(gal/min)	(MGD)	Percent of Maximum Design Intake Flow (%) Note: DIF = 36 MGD
2018	8,117,581,704	365	22,239,950	15,444	22.24	61.8
2017*	7,141,491,034	365	19,565,729	13,587	19.57	54.3
2016	8,383,706,926	366	22,906,303	15,907	22.91	63.6
2015*	7,391,298,555	365	20,250,133	14,063	20.25	56.3
2014	8,081,877,394	365	22,142,130	15,376	22.14	61.5

* Maintenance outage years

As shown in Table 3-1, CGS's typical intake flow rate is approximately 54 to 64 percent of the maximum design intake flow rate of 36 MGD.

Water withdrawn from the Columbia River supports the closed cycle cooling system that consists of six mechanical-draft cooling towers, and the following: the Standby Service Water Ponds, Fire Protection, Potable Water, and Demineralized Water. The vast majority of the water withdrawn from the river however, is utilized by the closed cycle cooling system. The closed cycle cooling system consists of the Circulating Water (CW) and the Plant Service Water (TSW) system. The percent of the flow used for cooling purposes by the CW/TSW system is estimated to approximately 90 to 99 percent. This amount is difficult to precisely determine due the lack of flow meters installed on a number of the plant's water distribution lines.

3.3 Flow Distribution and Water Balance Diagram

The water balance diagram for CGS is provided in Figure 3-5. It is important to note that a number of flows provided on the diagram are estimated.

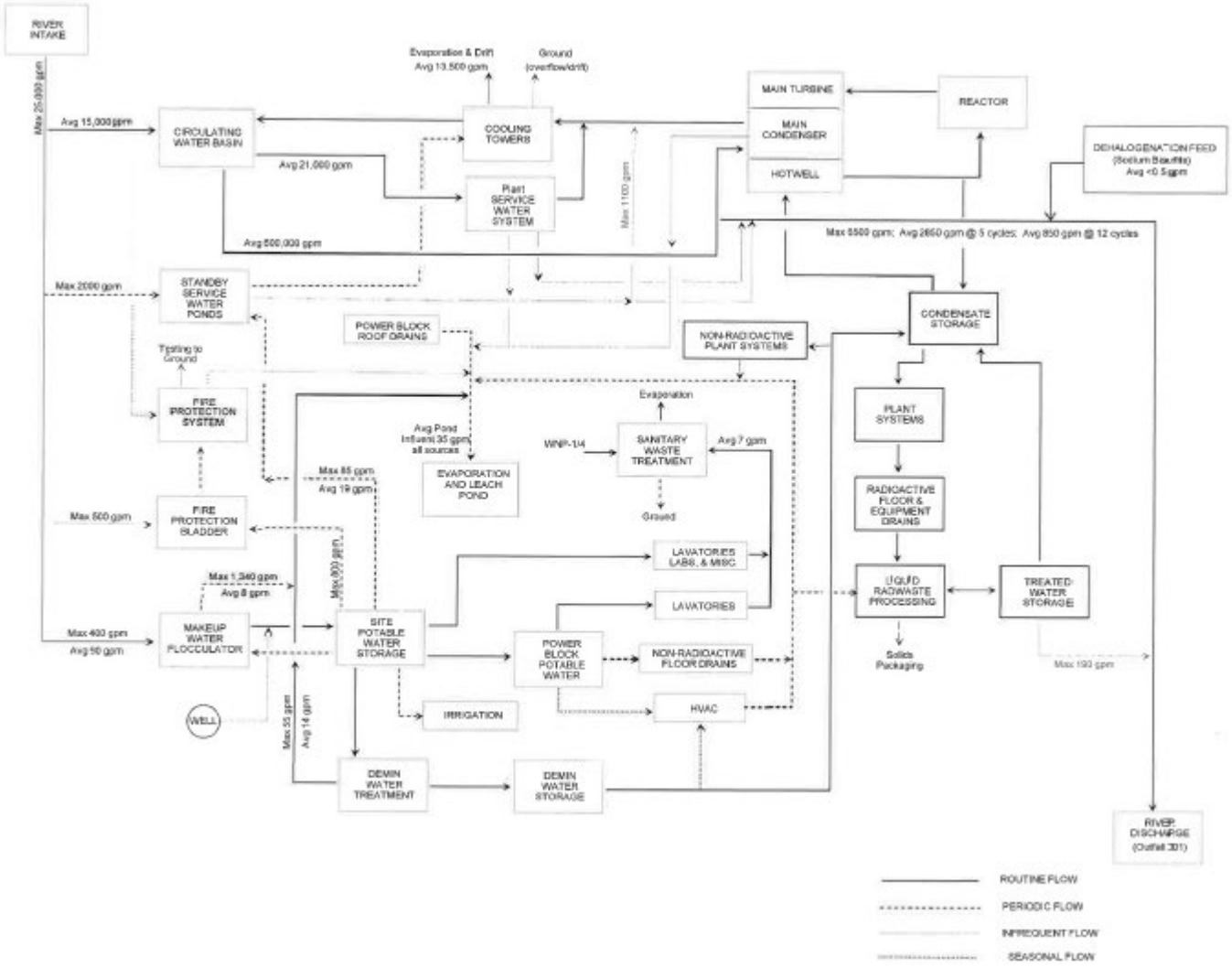


Figure 3-5: CGS flow diagram

4. 40 CFR 122.21(r)(4) Source water baseline biological characterization data

40 CFR 122.21(r)(4) requires source water biological baseline characterization data for the Hanford Reach of the Columbia River in the vicinity of CGS.

4.1 40 CFR 122.21(r)(4)(i): List of data required in paragraphs (r)(4)(ii) through (r)(4)(vi) that were not available with an explanation of efforts to identify sources of that data.

Biological community data for the Hanford Reach of the Columbia River near the CGS CWIS is mostly focused on salmonid species. CGS has commissioned a detailed impingement and entrainment studies conducted for the CGS CWIS that offer data on the potential for susceptible species and life stages to impinge or entrain. A literature search was conducted to obtain any additional relevant data for species in the vicinity of CGS and is included as an appendix in the Interim Fish Entrainment Report for CGS (Anchor 2019).

4.2 40 CFR 122.21(r)(4)(ii): List of species (or relevant taxa) for all life stages and their relative abundance near the CWIS.

Fishery survey and scientific studies conducted near the vicinity of the CGS CWIS that provide limited information on the life stages and abundance of fish are limited and mostly focus on anadromous salmonid species. A list of species in the Hanford Reach of the Columbia River was compiled from a variety of historical sources (Table 4-1). The supporting data contained in this table, sources and additional detail are discussed in the Interim Fish Entrainment Report for CGS (Anchor 2019).

Table 4-1 Species located in the vicinity of the CGS CWIS and their Federal Status

Family	Common Name[a]	Scientific Name[a]	Life Stage	Relative Abundance Near CGS[1]	Approximate Size (mm)	Seasonal Occurrence	Habitat Uses	Preferred Habitat	Preferred Depth (ft)	Preferred Velocity (ft/s)	State	Federal	Origin
Bullhead Catfishes	Black Bullhead	*Ameiurus melas*	Juvenile	Uncommon	<170	Year-Round	Rearing	Nearshore, Backwaters	Shallow to moderate	Low	--	--	Non-native
Bullhead Catfishes	Brown Bullhead	*Ameiurus nebulosus*	Juvenile	Uncommon	<190	Year-Round	Rearing	Nearshore, Backwaters	Shallow to moderate	Low	--	--	Non-native
Bullhead Catfishes	Yellow Bullhead	*Ameiurus natalis*	Juvenile	Uncommon	<110	Year-Round	Rearing	Nearshore, Backwaters	Shallow to moderate	Low	--	--	Non-native
Bullhead Catfishes	Channel Catfish	*Ictalurus punctatus*	Juvenile	Uncommon	<250	Year-Round	Rearing	Nearshore, Backwaters, Pools	Shallow	Moderate to High	--	--	Non-native
Herrings	American Shad	*Alosa sapidissima*	Juvenile*	Abundant	75-125	Late Jun-late fall	Rearing	Nearshore	3-20	0.1-2.5	--	--	Non-native
Lamprey	Pacific Lamprey	*Lampetra tridentata*	Ammocoetes*	Common	< 125	Year-Round	Rearing	Mid-channel/Benthic	2 to 2.5	< 0.8 (pref <0.3)	--	Concern	Native
Lamprey	Pacific Lamprey	*Lampetra tridentata*	Macrophthalmia	Common	125-200	October - early spring	Migratory	Mid-channel/Benthic	3 to 40	High; individuals drift with flow	--	Concern	Native
Lamprey	River Lamprey	*Lampetra ayresii*	Ammocoetes*	Uncommon	< 175	Year-Round	Rearing	Mid-channel/Benthic	Shallow to moderate	<0.5 - 0.1	Candidate	Concern	Native
Lamprey	River Lamprey	*Lampetra ayresii*	Macrophthalmia	Uncommon	> 175	Early Apr - mid-June	Migratory	Mid-channel/Benthic	Deep	High; individuals drift with flow	Candidate	Concern	Native
Livebearers	Western Mosquitofish	*Gambusia affinis*	Adult	Uncommon	> 40	Year-Round	Resident	Nearshore, Backwaters, Pools	Shallow	Low	--	--	Non-native
Livebearers	Western Mosquitofish	*Gambusia affinis*	Juvenile	Uncommon	< 40	Year-Round	Rearing	Nearshore, Backwaters, Pools	Shallow	Low	--	--	Non-native
Minnows and Carps	Longnose Dace	*Rhinichthys cataractae*	Subadult/Adult	Common	100-125	Year-Round	Resident	Benthic	3	3	--	--	Native
Minnows and Carps	Longnose Dace	*Rhinichthys cataractae*	Juvenile*	Common	7-100	Mid May - Mid July	Rearing	Mid-channel	1.5	3	--	--	Native
Minnows and Carps	Northern Pikeminnow	*Ptychocheilus oregonensis*	Subadult/Adult	Abundant	75 - 440	Year-Round	Resident	Mid-channel, Nearshore	>15	>3	--	--	Native
Minnows and Carps	Peamouth	*Mylocheilus caurinus*	Subadult/Adult	Abundant	75 - 290	Year-Round	Resident	Mid-channel, Nearshore	Shallow to deep	Low to Moderate	--	--	Native
Minnows and Carps	Chiselmouth	*Acrocheilus alutaceus*	Subadult/Adult	Common	65-290	Year-Round	Rearing	Mid-channel, Nearshore, Pools	Shallow to deep	Low to Moderate	--	--	Native
Minnows and Carps	Redside Shiner	*Richardsonius balteatus*	Subadult/Adult	Abundant	120-140	Year-Round	Resident	Nearshore	Shallow	Low to Moderate	--	--	Native
Minnows and Carps	Northern Pikeminnow	*Ptychocheilus oregonensis*	Juvenile (Age 0)	Abundant	9-75	Year-Round	Rearing	Nearshore	<15	<3	--	--	Native
Minnows and Carps	Peamouth	*Mylocheilus caurinus*	Juvenile (Age 0)	Abundant	9-75	Year-Round	Rearing	Nearshore	Shallow	Low	--	--	Native
Minnows and Carps	Common Carp	*Cyprinus carpio*	Juvenile	Present	6-305	spring-summer	Resident	Nearshore	<4	Low	--	--	Non-native

Table 4-1 Species located in the vicinity of the CGS CWIS and their Federal Status

Family	Common Name[a]	Scientific Name[a]	Life Stage	Relative Abundance Near CGS[1]	Approximate Size (mm)	Seasonal Occurrence	Habitat Uses	Preferred Habitat	Preferred Depth (ft)	Preferred Velocity (ft/s)	State	Federal	Origin
Minnows and Carps	Umatilla Dace	*Rhinichthys umatilla*	Subadult/Adult	Uncommon	50 -100	Year-Round	Resident	Nearshore	< 3.3	< 1.5	Candidate	--	Native
Minnows and Carps	Umatilla Dace	*Rhinichthys umatilla*	Juvenile	Uncommon	< 50	Year-Round	Rearing	Nearshore	< 3.3	Low to Moderate	Candidate	--	Native
Minnows and Carps	Tench	*Tinca tinca*	Juvenile (Age 0)	Uncommon	< 75	Year-Round	Rearing	Nearshore, Backwaters, Pools	Shallow	Low	--	--	Non-native
Minnows and Carps	Redside Shiner	*Richardsonius balteatus*	Juvenile	Abundant	<50 - 120	Jul-Sep	Rearing	Nearshore, Pools	Shallow	Low to Moderate	--	--	Native
Minnows and Carps	Speckled Dace	*Rhinichthys osculus*	Subadult/Adult	Present	50 -100	Year-Round	Resident	Nearshore, Benthic/Pools, Runs, Riffles	<3	Low to High	--	--	Native
Minnows and Carps	Speckled Dace	*Rhinichthys osculus*	Juvenile	Present	< 50	Year-Round	Rearing	Nearshore, Benthic/Pools, Runs, Riffles	<3	Low	--	--	Native
Minnows and Carps	Leopard Dace	*Rhinichthys falcatus*	Juvenile*	Present	7-70	Mid May - Early Aug	Rearing	Nearshore/Benthic	1.5	1.5	Candidate	--	Native
Minnows and Carps	Leopard Dace	*Rhinichthys falcatus*	Subadult/Adult	Present	70-120	Year-Round	Resident	Nearshore/Benthic, Pools, Riffles	3	1.5	Candidate	--	Native
Minnows and Carps	Chiselmouth	*Acrocheilus alutaceus*	Juvenile (Age 0)	Uncommon	<65	Year-Round	Rearing	Tributary streams	1.5	0.4	--	--	Native
Perches	Yellow Perch	*Perca flavenscens*	Juvenile	Present	<10 - 130	Year-Round	Rearing	Nearshore	Shallow	Low	--	--	Non-native
Perches	Walleye	*Sander vitreus*	Juvenile*	Present	13-225	Year-Round	Rearing	Nearshore/Benthic	1	Low	--	--	Non-native
Salmonids	Mountain Whitefish	*Prosopium williamsoni*	Juvenile (Age 0)	Common	15-100	Year-Round	Rearing	Benthic	< 1	0.9	--	--	Native
Salmonids	Chinook Salmon, Spring	*Oncorhynchus tshawytscha*	Smolt	Common	100-225	Late Apr	Migratory	Mid-channel	6.5-40	3.2-4.7	Candidate	Endangered	Native
Salmonids	Coho Salmon	*Oncorhynchus kisutch*	Smolt	Common	90-130	Late Apr - Mid May	Migratory	Mid-channel	5-40	3.2-4.7	--	--	Native
Salmonids	Sockeye Salmon	*Oncorhynchus nerka*	Smolt	Common	74-100	Mid Apr - Late June	Migratory	Mid-channel	6.5-40	3.2-4.7	--	--	Native
Salmonids	Steelhead	*Oncorhynchus mykiss*	Smolt	Present	165-240	Late Apr - Early Jun	Migratory	Mid-channel	13-40	4.2-4.7	Candidate	Threatened	Native
Salmonids	Chinook Salmon, Fall	*Oncorhynchus tshawytscha*	Juvenile (Age 0)	Abundant	45-80	Mid Mar - Mid June	Rearing	Mid-channel, Nearshore	5-20	0.6-2.6	--	--	Native
Salmonids	Steelhead	*Oncorhynchus mykiss*	Juvenile (Age 0)	Present	35 - 155	Year-Round	Rearing	Mid-channel, Nearshore	< 10	<1.5	Candidate	Threatened	Native
Sculpins	Mottled Sculpin	*Cottus bairdii*	Adult	Present	25-125	Year-Round	Resident	Mid-channel/Benthic, Nearshore	0.5-3	1-3	--	--	Native

Table 4-1 Species located in the vicinity of the CGS CWIS and their Federal Status

Family	Common Name[a]	Scientific Name[a]	Life Stage	Relative Abundance Near CGS[1]	Approximate Size (mm)	Seasonal Occurrence	Habitat Uses	Preferred Habitat	Preferred Depth (ft)	Preferred Velocity (ft/s)	State	Federal	Origin
Sculpins	Mottled Sculpin	*Cottus bairdii*	Juvenile (Age 0)	Present	6-25	Mar-Jul	Rearing	Mid-channel/Benthic, Nearshore	0.5-3	1-3	--	--	Native
Sculpins	Torrent Sculpin	*Cottus rhotheus*	Adult	Present	25 - 152	Year-Round	Resident	Mid-channel/Benthic, Nearshore	Shallow	1.4-4	--	--	Native
Sculpins	Torrent Sculpin	*Cottus rhotheus*	Juvenile (Age 0)	Present	< 25	May-Late Jul	Rearing	Mid-channel/Benthic, Nearshore	Shallow	1.4-4	--	--	Native
Sculpins	Paiute Sculpin	*Cottus beldingi*	Adult	Uncommon	35-125	Year-Round	Resident	Mid-channel/Benthic, Nearshore	Shallow	1.4-4	--	--	Native
Sculpins	Paiute Sculpin	*Cottus beldingi*	Juvenile (Age 0)	Uncommon	< 35	May-Late Jul	Rearing	Mid-channel/Benthic, Nearshore	Shallow	1.4-4	--	--	Native
Sculpins	Prickley Sculpin	*Cottus asper*	Adult	Present	13-150	Year-Round	Resident	Nearshore/Benthic	0.5-3	Low	--	--	Native
Sculpins	Prickley Sculpin	*Cottus asper*	Juvenile (Age 0)*	Present	13-35	May-Late Jul	Rearing	Nearshore/Benthic	0.5-3	Low	--	--	Native
Sculpins	Reticulate Sculpin	*Cottus perplexus*	Adult	Uncommon	40-100	Year-Round	Resident	Nearshore/Pools, Riffles	Shallow	0-4	--	--	Native
Sculpins	Reticulate Sculpin	*Cottus perplexus*	Juvenile	Uncommon	< 43	Year-Round	Rearing	Nearshore/Pools, Riffles	Shallow	0-4	--	--	Native
Sticklebacks	Threespine Stickleback	*Gasterosteus aculeatus*	Adult	Uncommon	55-75	Year-Round	Resident	Mid-channel/Benthic, Nearshore	Shallow to moderate	Low	--	--	Native
Sticklebacks	Threespine Stickleback	*Gasterosteus aculeatus*	Juvenile	Uncommon	< 55	Year-Round	Rearing	Mid-channel/Benthic, Nearshore	Shallow to moderate	Low	--	--	Native
Sturgeons	White Sturgeon	*Acipenser transmontanus*	Juvenile (Age 0)*	Present	< 280	Mid May - Late July	Rearing	Mid-channel/Benthic, Nearshore	40-90	1.3	--	--	Native
Suckers	Bridgelip Sucker	*Catostomus columbianus*	Juvenile	Common	< 200	Year-Round	Rearing	Mid-channel	2-8	Low	--	--	Native
Suckers	Mountain Sucker	*Catostomus platyrhynchus*	Juvenile	Present	40-125	Year-Round	Rearing	Mid-channel	3.3-5	1.5	Candidate	--	Native
Suckers	Mountain Sucker	*Catostomus platyrhynchus*	Juvenile (Age 0)	Present	25-40	July-Sep	Rearing	Nearshore	0.5-1.3	Low to Moderate	Candidate	--	Native
Suckers	Longnose Sucker	*Catostomus catostomus*	Juvenile	Uncommon	< 200	Year-Round	Rearing	Pools	Shallow	Low	--	--	Native
Suckers	Longnose Sucker	*Catostomus catostomus*	Juvenile (Age 0)	Uncommon	< 75	June - Sep	Rearing	Pools	< 11	Low	--	--	Native

Table 4-1 Species located in the vicinity of the CGS CWIS and their Federal Status

Family	Common Name[a]	Scientific Name[a]	Life Stage	Relative Abundance Near CGS[1]	Approximate Size (mm)	Seasonal Occurrence	Habitat Uses	Preferred Habitat	Preferred Depth (ft)	Preferred Velocity (ft/s)	State	Federal	Origin
Suckers	Bridgelip Sucker	*Catostomus columbianus*	Juvenile (Age 0)	Common	< 80	Mid May - Sep	Rearing	Pools, Nearshore	0.03-2	Low	--	--	Native
Suckers	Largescale Sucker	*Catostomus macrocheilus*	Juvenile (Age 0)*	Common	8-55	Jun-Aug	Rearing	Pools, Nearshore	0.32 -15	Low	--	--	Native
Sunfishes	Bluegill	*Lepomis macrochirus*	Juvenile	Present	< 90	Year-Round	Rearing	Backwaters	Shallow	Low	--	--	Non-native
Sunfishes	Pumpkinseed	*Lepomis gibbosus*	Juvenile	Present	< 90	Year-Round	Rearing	Backwaters	Shallow	Low	--	--	Non-native
Sunfishes	Largemouth Bass	*Micropterus salmoides*	Juvenile (Age 0)	Uncommon	6-190	Year-Round	Rearing	Backwaters	< 20	Low	--	--	Non-native
Sunfishes	Burbot	*Lota lota*	Juvenile (Age 0)	Uncommon	< 205	Year-Round	Rearing	Deep nearshore, Deep pools	Shallow to moderate	Low	--	--	Native
Sunfishes	Black Crappie	*Pomoxis nigromaculatus*	Juvenile (Age 0)	Present	< 105	Year-Round	Rearing	Mid-channel, Nearshore	< 10	Low	--	--	Non-native
Sunfishes	White Crappie	*Pomoxis annularis*	Juvenile (Age 0)	Present	< 125	Year-Round	Rearing	Mid-channel, Nearshore	< 10	Low	--	--	Non-native
Sunfishes	Smallmouth Bass	*Micropterus dolomieui*	Juvenile (Age 0)	Present	< 80	July-Winter	Rearing	Nearshore	< 25	Low	--	--	Non-native
Trout-perches	Sand Roller	*Percopsis transmontana*	Adult	Uncommon	75-105	Year-Round	Resident	Mid-channel, Nearshore	3-70	Low	Monitor	--	Native
Trout-perches	Sand Roller	*Percopsis transmontana*	Juvenile	Uncommon	< 75	Year-Round	Rearing	Nearshore	3-70	Low	Monitor	--	Native

Notes:

* Eggs may drift or larvae have a pelagic phase

1. Relative Abundances: Abundant = >10%, Common = > 1%, Present = < 1% (as reported in WPPSS 1982). Some species are noted as abundant or present in other literature but not directly observed in CGS studies. Uncommon = suspected presence but rarely observed Sources:

4.3 40 CFR 122.21(r)(4)(iii): Identification of species and life stage that would be most susceptible to impingement and entrainment. Species evaluated must include the forage base as well as those important in terms of significance to commercial and recreational fisheries.

Of all species and life stages that are known to occur in the Hanford Reach and listed in Table 4-1, a subset can be identified that are at elevated risk of entrainment or impingement because their habitat preferences increase their potential to occur in proximity to the CGS intake. The species listed in Table 4-2 are: 1) abundant in the Hanford Reach; 2) prefer mid-channel or benthic habitat; and 3) inhabit waters where conditions exceed the minimum depth and velocity observed at the CGS intake site of 8 feet and 3 ft^3/s, respectively. The subset of species and life stages listed are also those that can be small in body size, increasing their risk of impingement or entrainment due to poor swimming ability or ability to pass through screen pores.

Of the 14 species listed in Table 4-2, nearly all overlap in proximity to CGS in September through October, with the exception of migratory salmonids. This exception includes Hanford Reach subyearling fall Chinook salmon, which typically have emigrated from the reach by September. March through June is when fall Chinook salmon fry emerge in the Hanford Reach and therefore are most at risk of entrainment. March through June is also when smolts from upstream tributaries are typically migrating through the Hanford Reach. Low flows in late summer through winter largely affect resident fish species and those with extended residency before outmigration (steelhead, lamprey). River discharge is typically lowest in October, resulting in lowest average monthly river depths and lowest sweeping velocities past the CGS intake.

Table 4-2. Impingement and Entrainment Potential for Species of Concern near CGS

Common Name	Scientific Name	Life Stage	Preferred Habitat Type	Preferred Depth (feet)	Preferred Velocity (ft/s)	Size (length in mm)
Herring						
American Shad	*Alosa sapidissima*	Juvenile (Age-0)*	Mid-channel, Sloughs	3 to 20	0.1 to 2.5	75 to 125
Lamprey						
Pacific Lamprey	*Lampetra tridentata*	Macrophthalmia	Mid-channel/ Benthic	3 to 40	High; individuals drift with flow	125 to 200
		Ammocoetes*	Mid-channel/ Benthic	2 to 3	Less than 0.8 (prefer less than 0.3)	Less than 125
Minnows and Carps						
Chiselmouth	*Acrocheilus alutaceus*	Juvenile	Nearshore, pools, then mid- channel later in summer	Shallow to deep	Low to Moderate	30 to 250
Northern Pikeminnow	*Ptychocheilus oregonensis*	Juvenile*	Nearshore, pools, then mid- channel later in summer	Greater than 15	Greater than 3	9 to 75

Common Name	Scientific Name	Life Stage	Preferred Habitat Type	Preferred Depth (feet)	Preferred Velocity (ft/s)	Size (length in mm)
Peamouth	*Mylocheilus caurinus*	Juvenile	Nearshore, then mid- channel later in summer	Shallow to deep	Low to Moderate	9 to 75
Salmonids						
Chinook Salmon, Fall	*Oncorhynchus tshawytscha*	Juvenile (Age-0)	Nearshore, then mid- channel later in summer	5 to 20	< 2.6	45 to 80
Chinook Salmon, Spring	*O. tshawytscha*	Smolt	Mid-channel	6.5 to 40	3 to 4.5	100 to 225
Coho Salmon	*O. kisutch*	Smolt	Mid-channel	5 to 40	3 to 4.5	90 to 130
Sockeye Salmon	*O. nerka*	Smolt	Mid-channel	6.5 to 40	3 to 4.5	74 to 100
Steelhead	*O. mykiss*	Juvenile (Age-0)	Nearshore, then mid- channel later in summer	Less than 10	Less than 1.5	35 to 155
Steelhead	*O. mykiss*	Smolt	Mid-channel	13 to 40	4 to 4.5	165 to 240
Suckers						
Bridgelip Sucker	*Catostomus columbianus*	Juvenile (Age-0)	Mid-channel	2 to 8	Low	Less than 80
Largescale Sucker	*C. macrocheilus*	Juvenile (Age-0)	Nearshore/ Benthic, Pools	0.3 to 15	Low	8 to 55
Note: *Larvae have a pelagic stage						

4.4 40 CFR 122.21(r)(4)(iv&v): Identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak abundance of relevant taxa. Seasonal and daily activities (e.g., feeding and water column migration) of biological organisms in the vicinity of the cooling water intake structure.

Specific information is only provided for relevant species (those of greatest concern or potential of impingement or entrainment) in the vicinity.

Salmonids

Chinook salmon (Onchorhychus tshawyscha)
The following has been summarized from the Interim Fish Entrainment Report for CGS (Anchor 2019).

Adult fall Chinook salmon enter freshwater at a fully mature state in late summer through fall, typically spawning in the Hanford Reach between mid-October through the third week of November. Fall Chinook salmon fry emerge from gravels from mid-March through mid-May, with peak emergence observed in mid- to- late April depending on water temperatures. Fry range in length between 37 and 44 mm fork length at emergence, and are highly dependent on shallow, shoreline habitats for feeding and sanctuary. Subyearling fall Chinook salmon feed and swim in the middle or upper portion of relatively shallow water (4 to 22 inches deep) during daytime, while during nighttime they remain less active in the lower portion of the water column. As subyearlings increase in size, they begin to inhabit deeper water with greater velocities. In

the Hanford Reach, subyearling fall Chinook salmon are most abundant in nearshore areas occupying water depths of 4.9 to 19.4 feet, and preferring velocities between 0.6 to 2.6 ft/s; however, subyearlings can be found across the full width of the river and in the upper, middle, and lower portions of the water column. Once the wild Fall Chinook smolt initiate downstream migration in late spring, they tend to travel rapidly through the free-flowing Hanford Reach.

Steelhead trout (Oncorhynchus mykiss)
The following has been summarized from the Interim Fish Entrainment Report for CGS (Anchor 2019).

Similar to fall Chinook salmon, steelhead spawn and rear within the Hanford Reach. The newly emerged fry are similarly small in size, but, in contrast, steelhead rear in the Hanford Reach for an entire year prior to migrating downstream. Population trends for steelhead in the Hanford Reach have not been intensively studied; however, their presence has been documented in redd surveys. Adult steelhead typically move into the Hanford Reach from August to November with a peak in September; however, they may be present in the reach year-round as they hold for 6 to 8 months prior to spawning. Adults tend to migrate near shorelines in water depths of less than 3 meters. Spawning has rarely been observed directly in the Hanford Reach, but is likely to occur between February and early June, with peak spawning in mid-May. Adult upper Columbia River steelhead typically use smaller tributary habitat and substrate to spawn in, compared to fall Chinook salmon, but steelhead will spawn in mainstem reaches of large rivers where suitable habitat exists. Habitat with suitable depths, velocity, substrate size, and substrate embeddedness for steelhead spawning exists in several locations throughout the Hanford Reach at flows that typically occur during the spawning season.

Steelhead fry emerge from the gravel 2 to 3 weeks after hatching, usually between mid-May through late-July. Fry are between 35 and 56 mm fork length, and immediately move to shoreline environments with vegetation and submerged cover. As fry grow larger, they move away from nearshore environments, occupying shallow riffles and pools, yet remaining outside of the main channel, preferring low water velocities (0.67 ft/s). Juveniles rear year-round in freshwater, and smolts begin their outmigration after 1 to 3 years in the river environment.

If steelhead spawning were common in the Hanford Reach it would be expected that age-0 (young-of-the-year) fry would be regularly observed in juvenile fish surveys. Observations of age-0 steelhead fry are limited however; numerous studies have failed to collect age-0 steelhead despite methods directed at collecting salmonids in this life stage, confirming the rarity of steelhead spawning in the Hanford Reach.

Lamprey

Pacific lamprey and Western river lamprey (Lampetra ayresii)
The following has been summarized from the Interim Fish Entrainment Report for CGS (Anchor 2019).

Pacific lamprey and Western river lamprey (Lampetra ayresii) reportedly occupy the Hanford Reach; however, no Western river lamprey have been observed in the Columbia Basin since 1980, and the species may have been extirpated from the drainage.

Both Pacific lamprey and Western river lamprey are anadromous, with a relatively complex life history. After hatching, larvae (ammocoetes) drift downstream and burrow in soft substrate in areas of low water velocity (less than 1 ft/s) to filter feed and rear for up to 8 years. After

metamorphosing, the macrophthalmia begin downstream migration, which usually occurs between late fall and spring. Lamprey mature into adults in the ocean, and spend several years in the marine environment. Adults migrate back to freshwater between February and June, and may spend up to a year in the freshwater habitat before spawning between March and July. Lamprey are largely nocturnal and generally migrate mid-channel in the lower part of the water column as they stop frequently to attach to substrate. Activity is usually restricted to darkness.

Both life stages are small, with ammocoetes usually less than 40 mm in length and 2 mm in width as yearlings, but can get as large as 174 mm in length. Macrophthalmia range between 75 to 200 mm in length and 6 to 11 mm in width at the eye. Ammocoetes are relatively immobile in low-flow environments; however, they may be displaced during high water events, particularly in the springtime, when soft sediment burrows are scoured. Macrophthalmia outmigration is relatively lengthy compared to salmonids. Macrophthalmia have been observed in the Columbia River during every month of the year, with peak numbers collected in winter and early spring, usually coinciding with high river discharge events; however, substantial numbers are also observed from March through October.

Minnows

Chiselmouth (*Acrocheilus alutaceus*), Peamouth (*Mylocheilus caurinus*), Northern pikeminnow (*Ptychocheilus oregonensis)*
The following has been summarized from the Interim Fish Entrainment Report for CGS (Anchor 2019).

An abundant resident fish population occurs in the Hanford Reach comprised of species that spend their entire life-cycle in the reach, in contrast to anadromous salmonids and lamprey that migrate long distances and only occur during portions of their life-cycle. Minnows make up the majority of the resident fish species present in the reach. In the Hanford Reach, minnows are predominantly found in shallow water habitat that occurs in side channels that have flowing water during periods of high flow and become backwater sloughs at lower flows. Adult minnows spawn between mid-May and early-August, with larvae emerging days to weeks later, depending on the species. Juveniles demonstrate preference for nearshore and shoreline environments, occupying relatively shallow (1.5 to 15 feet) water with low velocities (0.36 to 3.3 ft/s). Age-0 juveniles of the minnow family are abundant in dense schools of mixed minnow and sucker species in shoreline areas with less than 1 meter (3.3 feet) of water from late June through September or October, following the spring and summer spawning season. Most adult minnows are also found in low velocity (less than 1.5 ft/s) environments, preferring shoreline environments during the warmer months, while retreating to deeper water from October through April.

Suckers

Bridgelip suckers (*Catostomus columbianus) and* Largescale suckers (*Catostomus macrocheilus*)
The following has been summarized from the Interim Fish Entrainment Report for CGS (Anchor 2019).

Largescale suckers are one of the most abundant species near the CGS intake system and juvenile suckers are some of the most abundant fish found in shallow shoreline areas of the Hanford Reach. Other species, such as the bridgelip sucker are also associated with the Hanford Reach, but relative abundance for these species is unknown. Species in the sucker

family inhabit the river environment year-round. Adult suckers generally prefer deeper water habitats during the day, while moving to shoreline environments during the night. All species can tolerate relatively strong currents, with water velocity ranging from 1.3 to 3.6 ft/s, with bridgelip suckers often found at the ends of riffles in the main river channel. Adults spawn between mid-April and July. Juveniles prefer shallower water, occupying pools, backwaters, and shoreline environments between 0.3 to 15 feet deep, between June and August.

Non-Native Species

American shad (*Alosa sapidissima*)
The following has been summarized from the Interim Fish Entrainment Report for CGS (Anchor 2019).

Larval and juvenile American shad have been observed in small numbers in backwaters and sloughs in the Hanford Reach. In the John Day Reservoir and below Bonneville Dam, American shad are one of the most abundant species (Petersen et al. 2003). Larval American shad are initially pelagic and can be found in plankton tows across the entire channel starting in late June, prior to recruiting to shallow shoreline areas in August. Age-0 juveniles are observed in nearshore areas from late July through September, before outmigrating to the ocean in late fall. Age-0 Juvenile shad may be found in water between 3 and 20 feet deep and relatively slow velocities of 0.1 to 2.5 ft/s.

4.5 40 CFR 122.21(r)(4)(vi): Identification of all Federally-listed threatened and endangered species and/or designated critical habitat that are or may be present in the action area.

Four species in the Hanford Reach of Columbia River Basin are on the Federal Endangered (E) or Threatened (T) Species List (Table 4-3). Of the four, the Pacific lamprey is the only species considered a species of concern (C) versus a threatened or endangered species.

Table 4-3 Federally-listed Threatened and Endangered Species

Family	Scientific Name	Common Name	Federal Status
Petromyzontidae	*Entosphenus tridentatus*	Pacific lamprey	C
Salmonidae	*Onchorhychus tshawyscha*	Chinook salmon	T
	Oncorhynchus mykiss	steelhead trout	T
	Salvelinus confluentus	Bull trout	T

Figures 4-1 to 4-4 show the range of the species in Table 4-3 within the Hanford Reach.

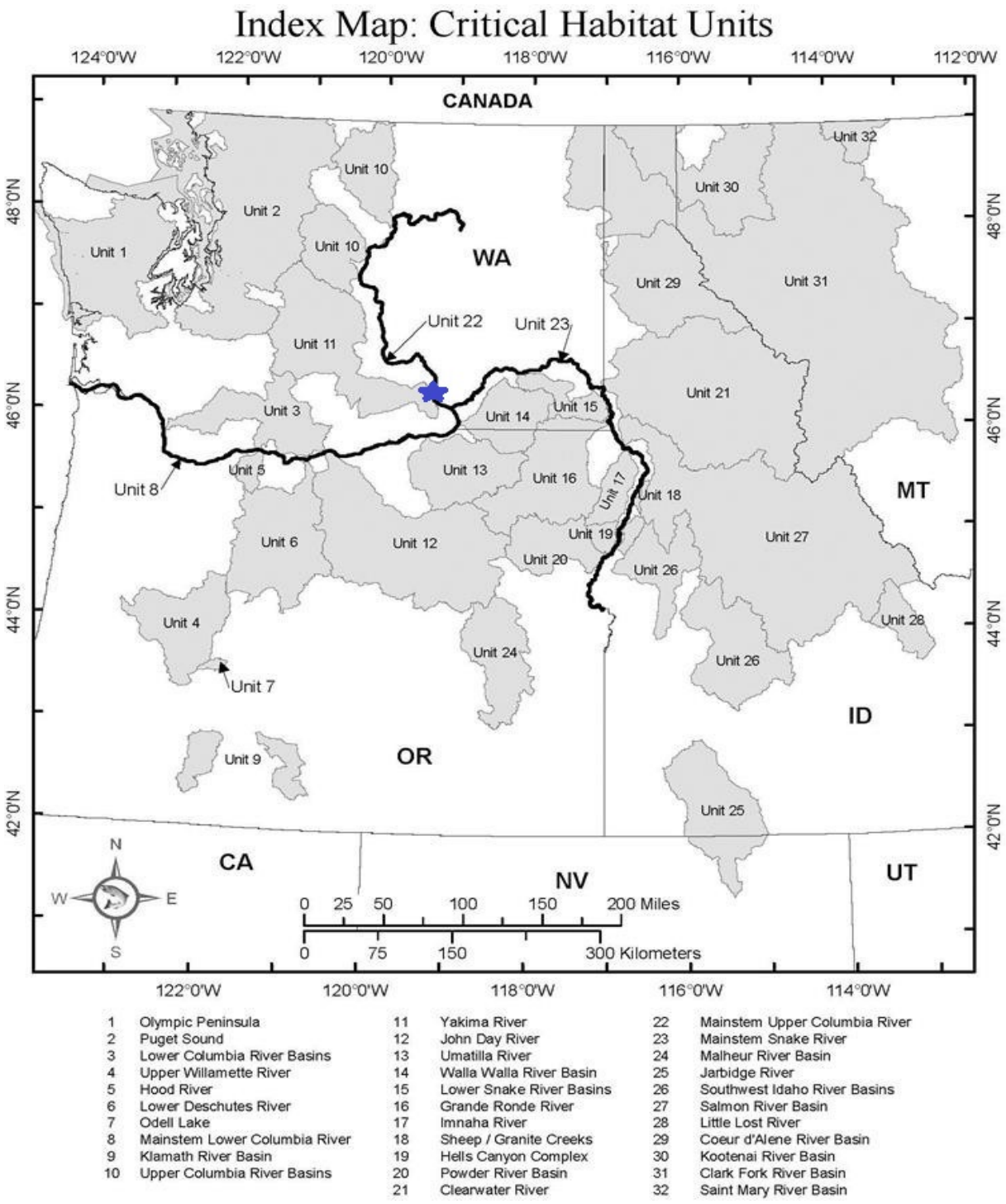


Figure 4-1: Critical habitat map for Bull Trout (USFW 2010)
(Note: Blue Star indicates location of CGS)

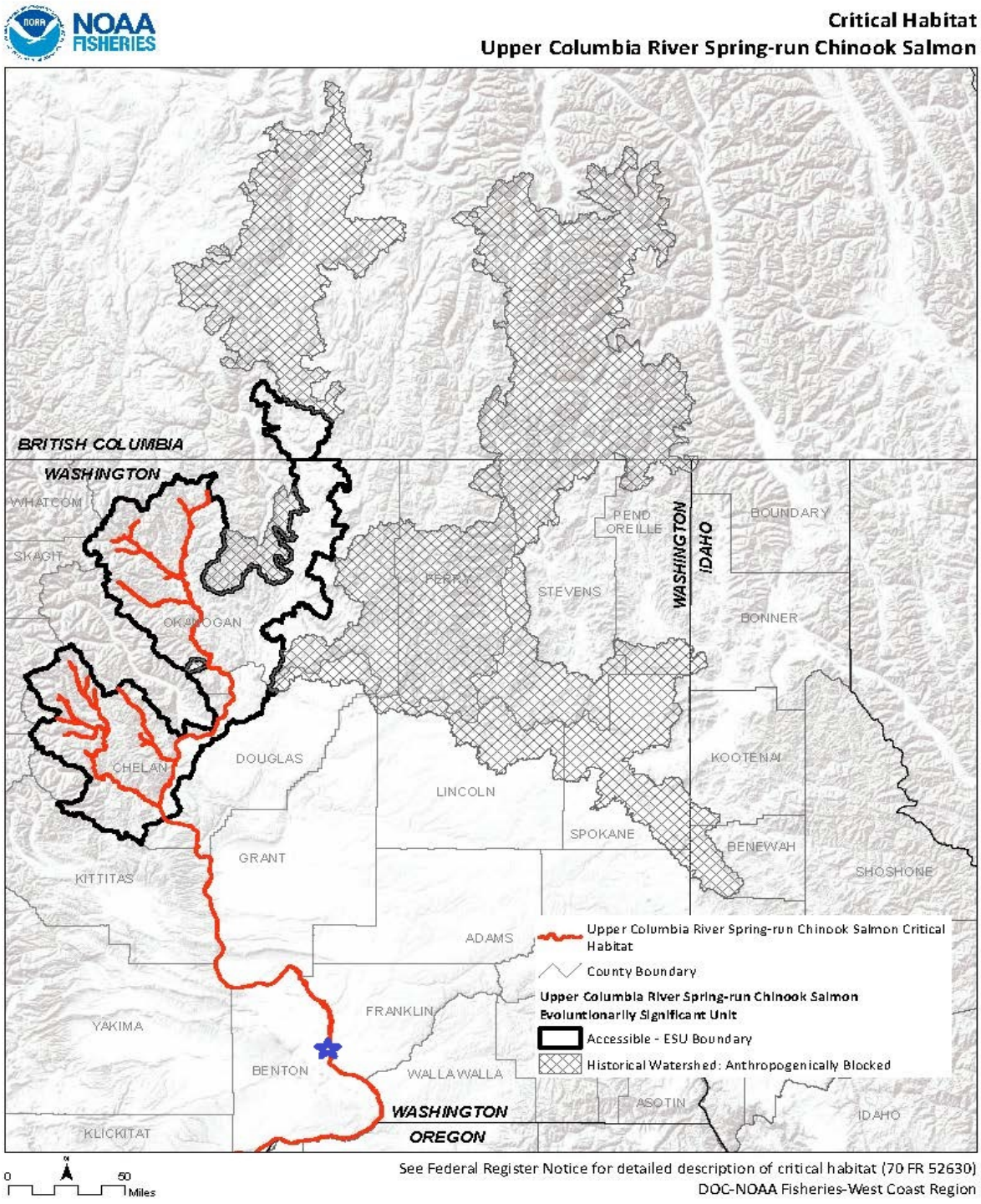


Figure 4-2: Critical habitat map for Chinook Salmon in the Upper Columbia River (NMFS 2019) (Note: Blue Star indicates location of CGS)

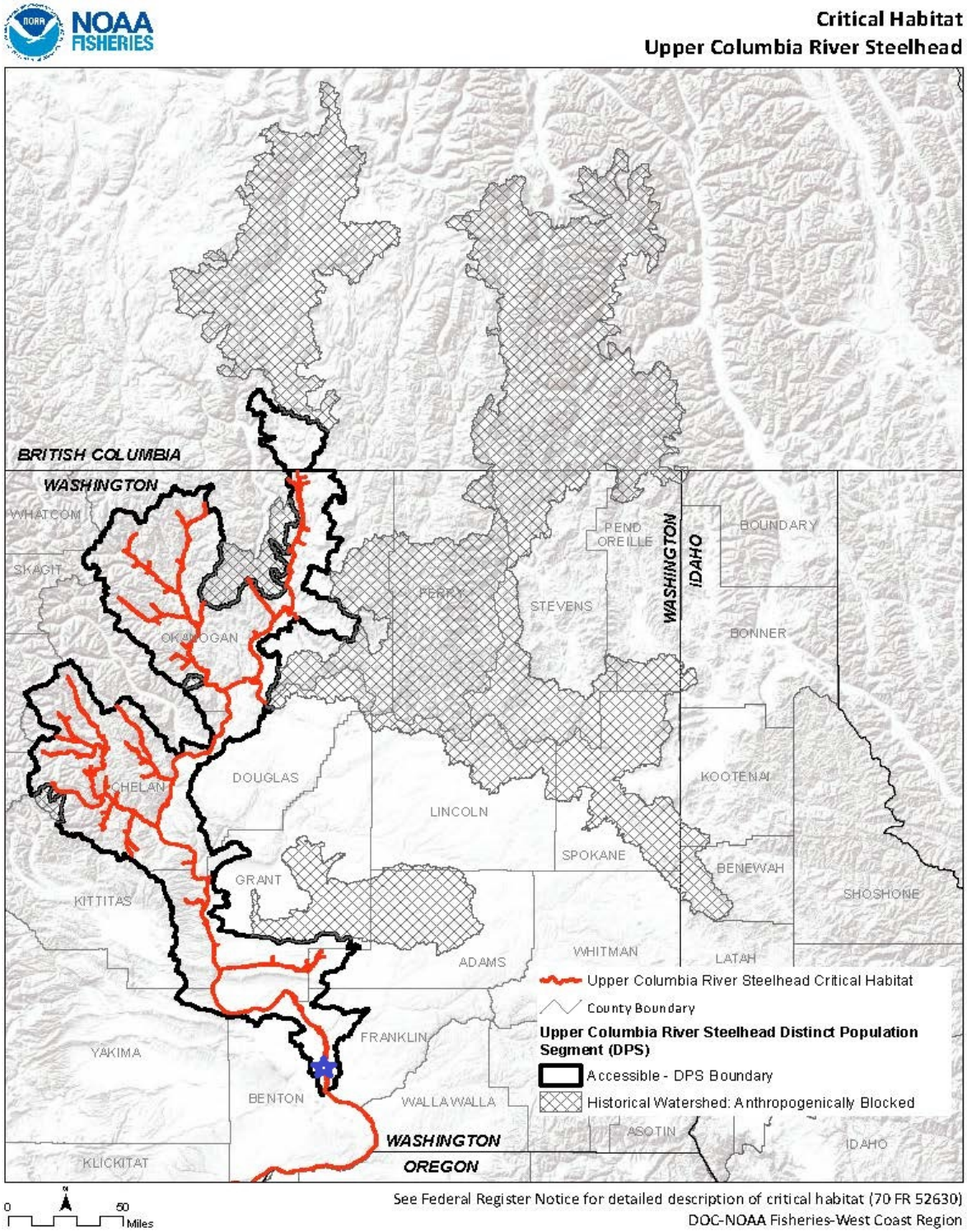


Figure 4-3: Critical habitat map for Steelhead in the Upper Columbia River (NMFS 2019)
(Note: Blue Star indicates location of CGS)

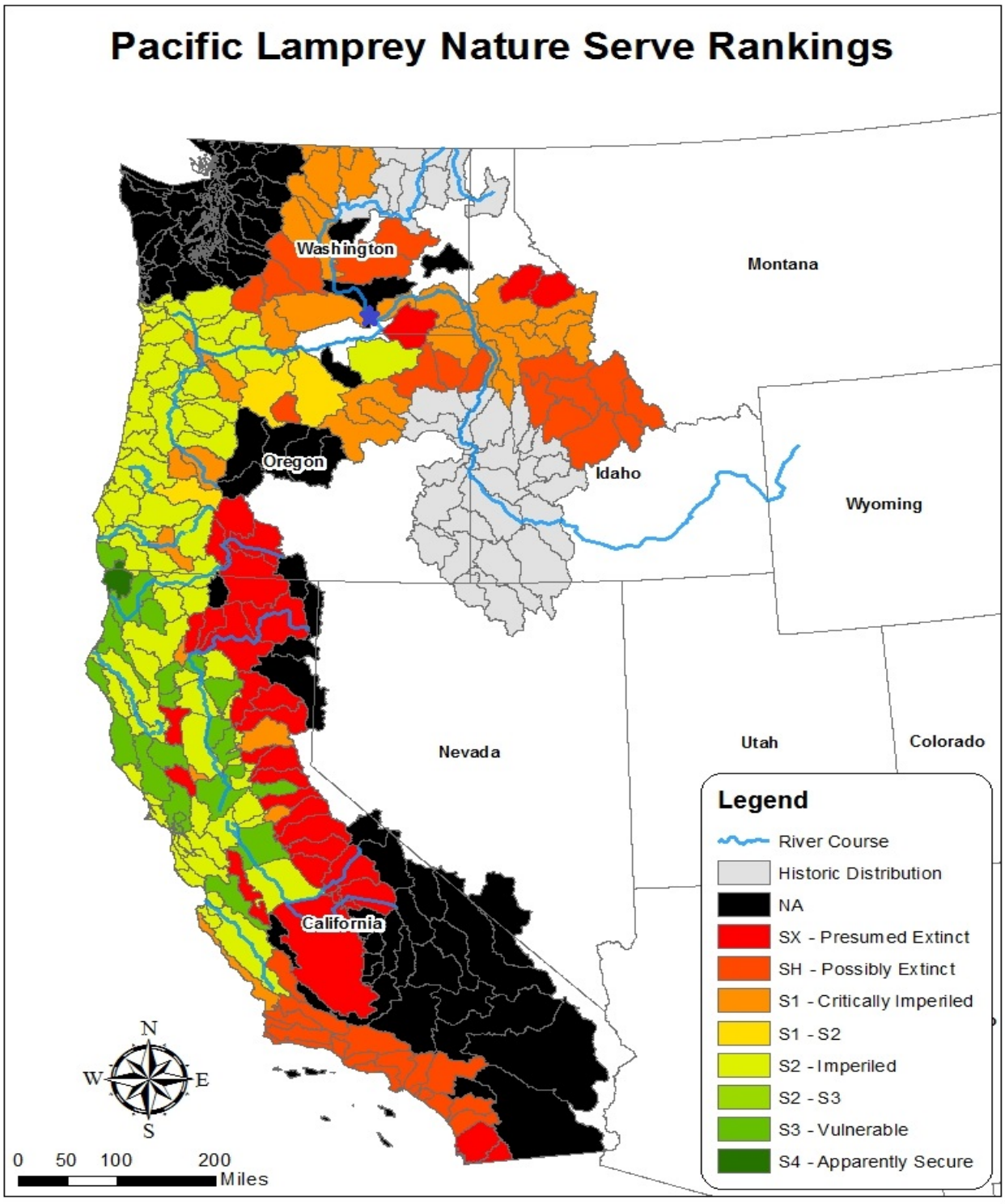


Figure 4-4: Relative Threat Rankings for Pacific Lamprey (USFWS 2019)
(Note: Blue star indicates location of CGS.)

4.6 40 CFR 122.21(r)(4)(vii): Documentation of any public participation or consultation with Federal or State agencies undertaken in development of the plan.

This section does not apply to CGS.

4.7 40 CFR 122.21(r)(4)(viii): If the information requested in paragraph (r)(4)(i) of this section is supplemented with data collected using field studies, supporting documentation for the Source Water Baseline Biological Characterization must include a description of all methods and quality assurance procedures for sampling, and data analysis including a description of the study area; taxonomic identification of sampled and evaluated biological assemblages (including all life stages of fish and shellfish); and sampling and data analysis methods. The sampling and/or data analysis methods you use must be appropriate for a quantitative survey and based on consideration of methods used in other biological studies performed within the same source water body. The study area should include, at a minimum, the area of influence of the cooling water intake structure.

Recent specific studies related to fish entrainment and impingement have, or are in the process of, being conducted for CGS and used extensively to support the discussion within this 122.21(r)(4) section. They include the following:

Computation Fluid Dynamics Analysis of Perforated Intake Screens at CGS (Alden 2018)
The hydrodynamic risks of fish impingement associated with the two 42-inch diameter cylindrical T-screen intake units currently used to withdraw water from the Columbia River for cooling operations at CGS were evaluated. The intent of this study was to analyze the physical flow patterns (i.e., velocity and pressure fields) around the screens using three-dimensional computational fluid dynamics (CFD) modeling, with CFD results to be interpreted by Alden's fish biologists and a third party consultant, Dr. Charles Coutant.

The report describes the CFD modeling approach and discusses the results in the context of risk of impingement (i.e., fish held to screen face by suction). A two-phased approach was taken in the modeling effort, with the first phase focused on simulating larger-scale (screen body-scale) dynamics around the two T-screen units and the second phase focused on simulating smaller-scale (fish-scale) dynamics in the turbulent boundary layer over individual holes of perforated screen areas.

The study had two main objectives: 1) Investigate patterns in velocity and pressure around the intake units, with a particular emphasis on the high pressure/low velocity region near the upstream noses of the units; and 2) Investigate the sweeping (tangential, across screen) and approach (normal, toward screen) components of velocity in the near-field turbulent boundary layer over the screens.

Specific methodologies for sampling and data analysis, procedures and analysis can be found with the report and was provided to the U.S. Nuclear Regulatory Commission (NRC), National Marine Fisheries Service (NMFS), Energy Facility Site Evaluation Council (EFSEC), and the Washington Department of Fish and Wildlife.

***Draft Entrainment Characterization Study Plan for the Columbia Generating Station, Richland, Washington* (Plan; Coutant 2014)**
A reissuance of National Pollutant Discharge Elimination System (NPDES) Permit No. WA-

002515-1 for CGS was published in 2014 by EFSEC. To address concerns regarding fish entrainment, NPDES Condition S12.B was included requiring CGS to prepare an entrainment characterization study that includes a 2-year fish entrainment monitoring study.

The design of the required fish entrainment study, described above, was outlined in this plan to guide the development and implementation of the fish entrainment study. This study plan was subject to three independent peer reviews and received approval from EFSEC.

Interim Fish Entrainment Report for Columbia Generating Station (Anchor 2019)

The interim report describes the results for the first year of the fish entrainment study, described above, which began in the spring of 2018. In addition to describing the methodology used to conduct the 2-year fish entrainment study, the results of the first years of sample, a review of existing literature was also included to identify fish species and life stages at risk of entrainment or impingement. The Historical Fish Occurrence Literature Review of the Hanford Reach is summarized in the interim report with the full literature review attached as Appendix F. The review of the Historical Fish Occurrence Literature Review was used extensively in in summarizing the responses of this document.

Specific methodologies for sampling and data collection, procedures and analysis can be found with the report. This report was submitted to EFSEC.

4.8 40 CFR 122.21(r)(4)(ix)—this part clarifies that the Source Water Baseline Characterization Data for owners/operators of existing facilities or new units at existing facilities is the information in paragraphs (r)(4)(i) through (xii) of this section.

This provision simply contains a statement of clarification and does not call for any specific information. The report does provide information required under §122.21(r)(4)(i-xii).

4.9 40 CFR 122.21(r)(4)(x): Identification of protective measures and stabilization activities that have been implemented, and a description of how these measures and activities affected the baseline water condition near the intake.

CGS has not conducted any protective measures and stabilization activities near the CWIS.

4.10 40 CFR 122.21(r)(4)(xi): List of fragile species, as defined at 40 CFR 125.92(m).

Fragile species means those species of fish and shellfish that are least likely to survive any form of impingement. As defined in 40 CFR 125.92(m), the only known fragile species is the American shad (Alosa sapidissima), which is a non-native species in the Columbia River.

4.11 40 CFR 122.21(r)(4)(xii): This section requires owners/operators of existing facilities that have incidental take exemptions or authorization for its cooling water intake structure(s) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, to provide any information submitted to obtain those exemptions or authorizations to satisfy the permit application information requirement of paragraph 40 CFR 125.95(f) if included in the application.

CGS was issued an Incidental Take Permit from the NMFS on March 10, 2017.

The following information was used to support the Endangered Species Act Section (7) consultation with NMFS for CGS operations:

Biological Assessment and Essential Fish Habitat Assessment, Columbia Generating Station, License Renewal (NRC 2011)

Generic Final Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 47, Columbia Generating Station (NRC 2012)

Computation Fluid Dynamics Analysis of Perforated Intake Screens at Columbia Generating Station (Alden 2018)

5. 40 CFR 122.21(r)(5) Cooling water system data

40 CFR 122.21(r)(5) requires the following cooling water system data:

(i) A narrative description of the operation of the cooling water system and its relationship to cooling water intake structures; the proportion of the design intake flow that is used in the system; the number of days of the year the cooling water system is in operation and seasonal changes in the operation of the system, if applicable; the proportion of design intake flow for contact cooling, non- contact cooling, and process uses; a distribution of water reuse to include cooling water reused as process water, process water reused for cooling, and the use of gray water for cooling; a description of reductions in total water withdrawals including cooling water intake flow reductions already achieved through minimized process water withdrawals; a description of any cooling water that is used in a manufacturing process either before or after it is used for cooling, including other recycled process water flows; the proportion of the source waterbody withdrawn (on a monthly basis);

(ii) Design and engineering calculations prepared by a qualified professional and supporting data to support the description required by paragraph (r)(5)(i) of this section; and

(iii) Description of existing impingement and entrainment technologies or operational measures and a summary of their performance, including but not limited to reductions in impingement mortality and entrainment due to intake location and reductions in total water withdrawals and usage.

The data presented in this section is used in determining the appropriate standards that would apply to the CGS facility.

5.1 Cooling water system design and operation

CGS is a nuclear-fueled steam electric power generation plant that discharges blowdown water from its non-contact cooling water system to the Columbia River. Demineralized water passes around zirconium tubes containing the reactor fuel in the core and is converted to steam at about 70 atmospheres (1,000 pounds per square inch [psi]). The electrical generator is turned by a steam-powered turbine, which converts thermal energy to mechanical energy and ultimately to electrical energy. The separate CW/TSW systems are used primarily to provide non-contact cooling water. The CW system non-contact cooling water is fed through the main condenser to convert steam from the closed-loop demineralized water system back into water that is returned to the reactor, and the TSW non-contact cooling water is fed through separate heat exchangers in the plant. The CW/TSW process water is recirculated through six

mechanical draft cooling towers where heat is discharged to the atmosphere. Evaporation, drift, and blowdown losses are replenished from the CWIS located in the Columbia River.

CGS operates under NPDES Permit No. WA002515-1, issued by EFSEC. Blowdown from the CW/TSW system is discharged to the primary outfall (NPDES Outfall 001) in the Columbia River, approximately 3 miles east of CGS. The major wastewater stream at CGS is the blowdown from the CW/TSW system.

As described above, the operations at CGS require the CW and TSW systems to provide non-contact cooling water. The CW system non-contact cooling water is fed through the main condenser to convert steam from the closed-loop demineralized water system back into water that is returned to the reactor, and the TSW non-contact cooling water is fed through separate heat exchangers in the plant. The combined CW/TSW process water is recirculated through six mechanical draft cooling towers where heat is discharged to the atmosphere. The CW/TSW system is circulated at approximately 600,000 gpm.

To limit the buildup of mineral salts, a small portion of the water is released to Outfall 001 to the Columbia River as blowdown. CGS typically operates between 5 and 12 cycles of recirculation. The blowdown discharge has an average flow rate of 2,850 gpm at five cycles of recirculation and 850 gpm at 12 cycles. During typical operation, the blowdown flow rate is approximately 1,300 to 1,650 gpm.

The cooling tower evaporation and drift loss on average is 13,500 gpm. This evaporation acts to concentrate the dissolved solids in the circulation water, cause excessive mineral salt deposition in the system, and result in a reduction in heat transfer (i.e., cooling) efficiency. To limit this buildup of mineral salts, a small portion of the concentrated water is released as blowdown to Outfall 001 in the Columbia River, and fresh makeup water is added to the system to offset the loss from evaporation and blowdown (Landau Associates 2018).

The CW/TSW system typically operates 24 hours per day and for 365 days per year. Every two years CGS is shut down for a refueling and maintenance outage and the CW/TSW system is taken out of service. These outages typically last for approximately 30 to 40 days.

There is also seasonal variation in the amount of water required by the CW/TSW system. The CW/TSW system requires more makeup water from the Columbia River in the summer months than during the winter months.

5.2 Proportion of Design Intake Flow for Non-contact Cooling and Process Uses

CGS has a Design Intake Flow (DIF) of 25,000 gpm (55.7 ft^3/s, 36 MGD). The majority of the intake flow is used by the CW/TSW system. The monthly amount of water withdrawn from the Columbia River from 2014 through 2018 is provided in the Table 5-1 below.

Table 5-1: Monthly Average Intake Flows (2014-2018)

Year	Average Actual Intake Flow (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	20.0	20.0	21.3	22.5	22.3	25.0	27.1	21.5	23.9	21.9	20.1	20.1
2015	19.4	21.0	24.7	24.3	7.4	4.1	21.5	28.0	26.2	23.3	20.8	10.6
2016	21.2	22.2	21.0	24.5	24.4	25.5	25.3	26.9	23.6	22.8	21.5	16.0
2017	18.9	20.2	21.7	15.9	10.4	12.1	28.4	19.6	22.5	23.0	22.0	20.2
2018	20.6	20.2	22.0	22.7	18.5	21.6	27.0	26.4	24.4	22.8	20.8	19.2

The monthly flow percentage used for cooling by the CW/TSW system is estimated to be approximately 90 to 99 percent of the average Actual Intake Flow (AIF).

5.3 Proportion of Source Water Body Withdrawn

CGS has a DIF of 25,000 gpm (55.7 ft^3/s, 36 MGD). The AIF varies throughout the year, based on the water demand at the facility. The average monthly AIF from 2014 through 2018, as presented in the Table 5-2, were used when calculating the percent of the Columbia River flow withdrawn by CGS.

Average monthly Columbia River flows were estimated using United States Geological Survey (USGS) flow data from the Priest Rapids Dam located upstream from CGS. The average monthly river flows for the period of record were compared to the DIF and the average monthly AIFs from 2014 through 2018 to estimate the percent of river flow withdrawn by CGS. The following equation was used to determine the proportion of the Columbia River flow withdrawn by CGS:

$$\textit{Proportion of Source Waterbody} = \frac{\textit{CGS Intake Flow } (ft^3/s)}{\textit{Columbia River Flow } (ft^3/s)} \times 100$$

The average monthly proportion of the Columbia River withdrawn by CGS for the DIF is provided in Table 5-2. As can be seen from the table, if operated at its current DIF, CGS will withdraw a maximum of 0.08 percent of the monthly Columbia River flow. The percent of the monthly river flow withdrawn by CGS from 2014 through 2018 is presented in Table 5-3. Over the past five years, CGS withdrew a maximum of 0.06 percent of the Columbia River flow, occurring during the months of September 2014, October 2017 and September 2018.

Table 5-2: Average Monthly Columbia River Flow (2014-2018) and Percent of Columbia River Flow Withdrawn by CGS

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean of Monthly Columbia River Discharge (ft^3/s)*	119,972	123,672	133,880	159,800	204,000	172,240	128,180	104,272	70,310	70,338	94,670	108,352.5
Design Intake Flow (36 MGD)												
Design Intake Flow (ft^3/s)	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7
Percent of River Flow	0.05%	0.05%	0.04%	0.03%	0.03%	0.03%	0.04%	0.05%	0.08%	0.08%	0.06%	0.05%
Monthly Daily Average Intake Flow (2014-2018)												
Actual Intake Flow (ft^3/s)	30.9	32.3	34.3	34.0	25.7	27.3	40.0	37.9	37.3	35.2	32.5	25.9
Percent of River Flow	0.03%	0.03%	0.03%	0.02%	0.01%	0.02%	0.03%	0.04%	0.05%	0.05%	0.03%	0.02%

Table 5-3: Average Monthly Columbia River Flow and Percent of Columbia River Flow Withdrawn by CGS (2014-2018)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014												
Columbia River monthly discharge (ft^3/s)*	99,360	76,560	124,800	148,400	196,300	187,200	161,700	117,000	66,270	70,430	93,660	114,900
Intake flow (ft^3/s)	30.9	30.9	33.0	34.9	34.5	38.6	41.9	33.3	37.0	33.8	31.1	31.1
Percent of river flow withdrawn	0.03%	0.04%	0.03%	0.02%	0.02%	0.02%	0.03%	0.03%	0.06%	0.05%	0.03%	0.03%
2015												
Columbia River monthly discharge (ft^3/s)*	139,200	155,700	140,700	118,200	124,600	119,000	106,200	110,100	73,780	72,040	95,330	94,110
Intake flow (ft^3/s)	30.1	32.4	38.2	37.6	11.5	6.3	33.3	43.3	40.6	36.0	32.2	16.4
Percent of river flow withdrawn	0.02%	0.02%	0.03%	0.03%	0.01%	0.01%	0.03%	0.04%	0.05%	0.05%	0.03%	0.02%
2016												
Columbia River monthly discharge (ft^3/s)*	101,300	107,000	120,800	166,100	146,300	136,300	116,700	99,150	68,510	80,860	107,900	122,300
Intake flow (ft^3/s)	32.7	34.4	32.6	37.8	37.8	39.5	39.2	41.7	36.5	35.3	33.2	24.8

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Percent of river flow withdrawn	0.03%	0.03%	0.03%	0.02%	0.03%	0.03%	0.03%	0.04%	0.05%	0.04%	0.03%	0.02%
2017												
Columbia River monthly discharge (ft^3/s)*	131,800	123,100	163,500	214,500	250,600	231,900	128,800	94,610	76,850	62,070	79,650	102,100
Intake flow (ft^3/s)	29.2	31.3	33.5	24.6	16.1	18.7	43.9	30.3	34.8	35.5	34.0	31.2
Percent of river flow withdrawn	0.02%	0.03%	0.02%	0.01%	0.01%	0.01%	0.03%	0.03%	0.05%	0.06%	0.04%	0.03%
2018												
Columbia River monthly discharge (ft^3/s)*	128,200	156,000	119,600	151,800	302,200	186,800	127,500	100,500	66,140	66,290	96,810	No data.[1]
Intake flow (ft^3/s)	31.9	32.3	34.0	35.1	28.7	33.4	41.7	40.9	37.7	35.2	32.1	---
Percent of river flow withdrawn	0.02%	0.02%	0.03%	0.02%	0.01%	0.02%	0.03%	0.04%	0.06%	0.05%	0.03%	---

*USGS 2019

[1] Columbia River discharge data at Priest Rapids Dam is unavailable for this month

5.4 Intake Velocities

The intake screens on the CWIS located in the Columbia River were designed for low through-screen velocities to minimize impingement and entrainment. The inlet velocities are expected to be well below the acceptable limit required for suitable protection of small fish when water is being taken into the system. At the external screen surface under maximum operating conditions (DIF of 25,000 gpm, 36 MGD), the velocity through the external screen openings is approximately 0.5 ft/s. At a distance of less than one third inch from the outer screen surface, the inlet approach velocity drops to 0.2 ft/s (WPPSS 1981). During reduced flow, the perforated pipe intake velocity characteristics would be proportionately reduced. For average intake conditions, the nominal bulk velocity approaching the screens (screen-normal direction) is 0.07 ft/s and the average normal through-pore velocity is 0.16 ft/s (Alden 2018).

5.5 Existing Impingement and Entrainment Reduction Measures

CGS utilizes screens on the CWIS located in the Columbia River to minimize impingement and entrainment of the biological community. See section 3.1 for a description of the screens.

6. 40 CFR 122.21(r)(6) Chosen method of compliance with impingement mortality standard

CGS has identified the pre-approved Option 1 (Closed-Cycle Recirculating System) of the Best Technology Available (BTA) Standards for Impingement Mortality as its applicable standard. EFSEC initially determined the CGS CWIS represent the best technology available in the Fact Sheet for the 2014 CGS NPDES permit renewal (EFSEC 2014).

7. 40 CFR 122.21(r)(7) Entrainment performance studies

40 CFR 122.21(r)(7) requires CGS to discuss entrainment performance studies for CGS. Specifically the Rule requires:

The owner or operator of an existing facility must submit any previously conducted studies or studies obtained from other facilities addressing technology efficacy, through-facility entrainment survival, and other entrainment studies. Any such submittals must include a description of each study, together with underlying data, and a summary of any conclusions or results. Any studies conducted at other locations must include an explanation as to why the data from other locations are relevant and representative of conditions at your facility. In the case of studies more than 10 years old, the applicant must explain why the data are still relevant and representative of conditions at the facility and explain how the data should be interpreted using the definition of entrainment at 40 CFR 125.92(h).

Historical Studies:
Fish entrainment studies have previously been conducted at CGS. Beak Consultants conducted entrainment studies in May 1979 to May 1980 as part of the Preoperational Environmental Monitoring Program for what was then called the Washington Public Power Supply System (WPPSS) Nuclear Project No. 2 (WNP-2) (Beak 1980; Mudge et al. 1981). No juvenile

salmonids were entrained. As a result of EFSEC's review, WPPSS was required to conduct additional studies during one spring (April-June) out-migration of naturally spawned juvenile salmon when the facility was at or above 75 percent power load (EFSEC Resolution 214 issued in 1982). Further review by NMFS (Evans 1983) established the study period would extend to September 15 (Sorensen 1983), although recent studies in the Hanford Reach indicate that entrainment sampling to this late date is not biologically relevant. The facility reached approximately 75 percent thermal (power) load in November 1984 and the studies were conducted in 1985 to fulfill the requirements set forth in EFSEC Resolution No. 214 and to address the concerns of NMFS. The entrainment sampling equipment for each study was the same as described in Mudge et al. (1981) and is largely the same for the current entrainment plan (Coutant 2014). During times when Chinook salmon juveniles were confirmed present in the vicinity by beach seining there were no fish, fish eggs or larvae collected during 294 hours of entrainment sampling with an average sampling period of just under 12 hours per sample (WPPSS 1985).

Fish impingement and biofouling at the intakes were also studied in 1985 using SCUBA divers (WPPSS 1985). On nine occasions between March 13 and December 3 (six of which took place in April-September when juvenile salmonids were likely present) divers inspected and reported any fish impingement on or interaction with the intake structure, the need for maintenance, accumulation of submerged debris and plugging of orifices by attached growths. Videotape logs were made in spring and fall. Although resident fish were seen around the intakes structures, there were no impinged fish found and no fouling by algae, insects, sponges or debris occurred that would impact proper operation of the intakes.

Current Studies:
The current entrainment monitoring study as prescribed in the Draft Entrainment Characterization Study Plan for CGS (Coutant 2014) and initially reported in the Interim Fish Entrainment Report for CGS (Anchor 2019), concentrates on entrainment of fall Chinook salmon fry. Through consultations with NMFS it is mutually recognized that newly emerged Chinook salmon derived from spawning beds in the Hanford Reach are the species and life stage most likely to be entrained. This is not a federally-listed species but its population's proximity to CGS, its abundance and its seasonal sizes near the CGS intake make it a useful surrogate for all entrainable fish. It is also in NMFS's regulatory authority through the Magnuson-Stevens Act.

Although other species and life stages of fish occur in the vicinity of the CGS intake, most salmonids including those with Federal listing are large enough that entrainment through the 3/8th-inch diameter pores of the intake would not be possible (Bell 1990; Nordlund 2013a). For example, downstream-migrating juveniles of Chinook (underyearlings >75 mm long and 12 mm deep), Steelhead (wild pre-smolt >125 mm long and 22 mm deep), Sockeye (89-127 mm long) and Coho salmon (yearling or older 89-114 mm) from populations spawning and rearing upstream in or upstream of the Hanford Reach would be excluded by a 3/8-inch mesh (for sizes sampled in the Hanford Reach see Dauble et al. 1989 and other Hanford reports cited above). In further support of this, a conclusion from the recently completed Computation Fluid Dynamics Analysis of Perforated Intake Screens at CGS (Alden 2018) found that the effective opening of a 3/8-inch pore within the Columbia River with high sweeping flow posed a very low entrainment risk to a circa 40 mm long salmon fry due to the large size of the fish relative to the small hydrodynamically-effective pore size (about 1/3 of the pore diameter or ~3 mm) (Alden 2018).

As outlined in the Interim Entrainment report, the first year of entrainment sampling indicate that few fish were entrained over the observation season, with only two fish observed during thirteen 24-hour sampling events. The small number of fish entrained is consistent with the findings of

previous monitoring (Anchor 2019, Mudge et al. 1981). Discharge from the upper Columbia River Basin and Priest Rapids Dam was exceptionally high in 2018 and peak flows occurred in May, approximately one month earlier than average, causing an interruption in routine fish entrainment monitoring activities. Nonetheless, the fish entrainment monitoring that was undertaken in March and April prior to the high flows coincided with the typical peak emergence period for Hanford Reach Fall Chinook Salmon, allowing for representative sampling during this key time of year. The second year of the entrainment study is ongoing as of the time of preparation of this report.

As indicated throughout this section and the report submission to EFSEC, both historically and currently, CGS has performed numerous entrainment and sampling studies which have demonstrated little to no actual entrainment, and very low risk of entrainment or impingement.

8. 40 CFR 122.21(r)(8) Operational status

40 CFR 122.21(r)(8) requires a description of the operational status of CGS. Specifically;

the owner or operator of an existing facility must submit a description of the operational status of each generating, production, or process unit that uses cooling water, including but not limited to:

(i) For power production or steam generation, descriptions of individual unit operating status including age of each unit, capacity utilization rate (or equivalent) for the previous 5 years, including any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors, including identification of any operating unit with a capacity utilization rate of less than 8 percent averaged over a 24-month block contiguous period, and any major upgrades completed within the last 15 years, including but not limited to boiler replacement, condenser replacement, turbine replacement, or changes to fuel type;

(ii) Descriptions of completed, approved, or scheduled uprates and Nuclear Regulatory Commission relicensing status of each unit at nuclear facilities;

(iii) For process units at your facility that use cooling water other than for power production or steam generation, if you intend to use reductions in flow or changes in operations to meet the requirements of 40 CFR 125.94(c), descriptions of individual production processes and product lines, operating status including age of each line, seasonal operation, including any extended or unusual outages that significantly affect current data for flow, impingement, entrainment, or other factors, any major upgrades completed within the last 15 years, and plans or schedules for decommissioning or replacement of process units or production processes and product lines;

(iv) For all manufacturing facilities, descriptions of current and future production schedules; and

(v) Descriptions of plans or schedules for any new units planned within the next 5 years.

8.1 Age and status

Commercial operation of CGS was initiated in December of 1984. The original license issued by the NRC was renewed in 2012. The license renewal extended CGS operations through December 2043. An additional license extension is possible.

8.2 Capacity utilization for the previous five years

The CGS capacity factor from 2014 through 2018 is provided in Table 8-1.

Table 8-1: CGS Capacity Factor (2014-2018)

Calendar Year	Capacity Factor[2]
2014	98.58%
2015	84.16%
2016	99.03%
2017	83.48%
2018	98.8%

2015 and 2017 were refueling and maintenance outage years.

8.3 Major upgrades in the past 15 years

The CGS main steam condenser was replaced during the 2011 refueling and maintenance outage. The brass condenser tubes were replaced with titanium to reduce copper content in reactor feed water and blowdown, reduce radiation exposure, and improve operational efficiencies.

In calendar year 2019, CGS is undergoing a process modification to improve inhibition of biological fouling of the CW/TSW systems. The modification will replace the batch cooling water halogenation process with a continuous halogenation and the installation of a dehalogenation feed prior to blowing down to the Columbia River. The modification was approved through Amendment #2 of NPDES Permit No. WA002515-1 in March 2019.

8.4 Completed, approved or scheduled uprates and NRC relicensing status

CGS operation began in 1984 during which the plant was licensed to operate at a rated power level of 3,323 Megawatts thermal (MWt). In 1995, CGS was approved to increase the generating capacity to 3,486 MWt.

In 2017, CGS was approved to increase the generating capacity to 3,544 MWt. This uprate was accomplished through more accurate means of measuring feedwater flow. Table 2 summarizes CGS power history.

Table 8-2: CGS Power History

Description	Rated thermal power (MWt)
Original licensed thermal power (1984)	3,323 MWt
Licensed thermal power uprate (1995)	3,486 MWt
Licensed thermal power uprate (2017)	3,544 MWt

8.5 Plans or schedules for decommissioning or replacement of units

CGS operating license issued by the NRC expires in December 2043. This date is used for the commencement of decommissioning activities.

The technical approach selected for the plant's decommissioning uses the SAFSTOR (Mothball with Delayed Dismantling) option. The SAFSTOR approach consists of placing and maintaining

[2] Capacity factor is the ratio of total generation divided by the maximum amount of electricity the plant could send to the grid at the most seasonally restrictive period (summer).

the facility in protective storage after fuel and source material are removed from the site. Initial mothball (plant lay-up) operations consist of general plant decommissioning, radiation surveys, processing and the disposal of the radioactive waste materials, securing a possession-only license, and implementing security surveillance and maintenance plans for the delay period. Delayed dismantling activities are initiated after the dormancy period resulting in the restoration and release of the site.

Decommissioning of the Independent Spent Fuel Storage Installation (ISFSI) will occur five years after ceasing of plant operations, contingent on all the spent fuel loaded Multi-Purpose Casks (MPCs) having been removed from the ISFSI by the U.S. Department of Energy (DOE) for off-site disposal. ISFSI decommissioning will consist of removal and disposal of overpacks for the MPCs and removal and disposal of residual radioactive material as needed to meet the 10 CFR 20.1402 criteria for unrestricted release of the ISFSI area.

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