URS

October 15, 2010

Mr. Victor Gregoire
Kean Miller Hawthorne D'Armond McCowan & Jarman LLP
301 Main Street, Suite 1800
Baton Rouge, Louisiana 70801

Subject: Incorporation of Additional Laboratory Analytical Data
Screening-Level Ecological Risk Assessment - June 29, 2010
Vermilion Parish School Board Property Section 16 T15S R01E
East White Lake Oil and Gas Field
Vermillion Parish, Louisiana

Dear Mr. Gregoire:

I have attached updated tables supporting calculations and additional reliance materials to the East White Lake Oil and Gas Field Screening-Level Ecological Risk Assessment (SLERA) to incorporate data collected and/or final laboratory reports received following my report of June 29, 2010. The additional laboratory data consist of surface water and sediment split samples collected by ICON in February, March, and May 2010.

The additional data support my conclusions from the June 29, 2010 SLERA that there are no unacceptable risks to the Site ecosystem.

Sincerely,

David Lingle

David Lingle
Senior Project Manager

URS Corporation
10550 Richmond Avenue, Suite 155
Houston, TX 77042

Table 1R
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																												
Sample ID	SED-1	SED-1	SED-2	SED-2	SED-3	SED-3	SED-4	SED-4	SED-5	SED-5	SED-6	SED-6	SED-7	SED-7	SED-8	SED-8	SED-8	SED-8	SED-9	SED-9	SED-9	SED-9	SED-10	SED-10	SED-11	SED-11	SED-11	SED-11	SED-12
Sample Depth (ft bgs)	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-2
Sample Date	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	5/6/10	5/6/10	2/25/10	2/25/10	5/5/10	5/5/10	2/25/10	2/25/10	2/25/10	2/25/10	5/6/10	5/6/10	2/25/10
Sampler	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA
Total Metals																													
Arsenic	**3.93 B**	**7.36**	**5.17 B**	**8.29**	**8.82 B**	**8.72**	**1.58 B**	**5.42**	**6.18**	**4.75**	**3.31**	**8.06**	**3.47 B**	**3.93**	**4.42 B**	**4.0**	**4.062 B**	**5.65**	**3.92 B**	**5.11**	**6.612**	**3.36**	**4.37**	**5.2**	**7.68**	**6.5**	**4.386 B**	**4.8**	**3.43 B**
Barium	**379**	**428**	**334**	**308**	**335**	**315**	**342**	**662**	**123**	**216**	**227**	**522**	**726**	**686**	**741**	**587**	**496**	**720**	**457**	**493**	**671**	**455**	**691**	**769**	**2,021**	**1,260**	**550**	**713**	**1,016**
Cadmium	**0.04 B**	<0.496	**1.26**	<0.496	<0.06	<0.496	<0.01	**0.594**	<0.02	<0.496	**2.1**	**1.21**	**0.10 B**	<0.496	<0.03	<0.497	<0.021	<0.498	---	---	<0.027	<0.498	---	---	---	---	<0.024	<0.498	---
Chromium	**3.5**	**19.4**	**8.74**	**19.2**	<0.16	**15.2**	**5.27**	**16.4**	<0.05	**15.3**	**3.57**	**24.1**	**6.91**	**19.0**	**4.67**	**18.0**	**14.8**	**12.4**	---	---	**13.9**	**13.8**	---	---	---	---	**14.5**	**13.6**	---
Lead	**22.48**	**22.3**	**26.22**	**21**	**26.74**	**19.9**	**11.9**	**22.4**	**14.86**	**15.4**	**18.73**	**55.2**	**20.99**	**19.9**	**22.77**	**20.1**	**21.2**	**18.9**	---	---	**20.4**	**19.6**	---	---	---	---	**18.8**	**19.3**	---
Mercury	**0.09**	**0.139**	**0.06**	<0.1	**0.14**	<0.1	**0.04**	**0.22**	**0.04**	**0.623**	**0.88**	**14.3**	**0.08**	**0.119**	**0.07**	<0.1	0.098 U	**0.121**	**0.06**	**0.168**	0.115 U	<0.1	**0.09**	**0.197**	**0.09**	**0.192**	0.096 U	<0.1	**0.07**
Selenium	<1.17	<0.198	<1.09	<1.98	<1.74	<1.99	<0.42	<1.98	<0.50	<1.99	<0.51	<1.98	<0.80	<1.98	<0.78	<1.99	<0.643	<1.99	<0.71	<1.99	<0.822	<1.99	<0.65	<1.99	**1.11 B**	<1.99	<0.731	<1.99	**1.53 B**
Strontium	**59.81**	**56.3**	**54.78**	**59.2**	**79.17**	**60.2**	**59.09**	**91.7**	**36.2**	**58.9**	**80.2**	**140**	**47.13**	**48.3**	**48.91**	**51.3**	**41.1**	**43.7**	---	---	**46.1**	**43.5**	---	---	---	---	**44.2**	**45.1**	---
Zinc	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**53.0**	**48.3**	---	---	**53.6**	**54.3**	---	---	---	---	**51.8**	**51.4**	---
Polycyclic Aromatic Hydrocarbons																													
2-Methylnaphthalene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.044	---	---	---	<0.056	---	---	---	---	---	<0.053	---	---
Acenaphthene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.046	---	---	---	<0.059	---	---	---	---	---	<0.056	---	---
Acenaphthylene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.028	---	---	---	<0.036	---	---	---	---	---	<0.032	---	---
Anthracene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.028	---	---	---	<0.036	---	---	---	---	---	<0.032	---	---
Benzo(a)anthracene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.036	---	---	---	<0.046	---	---	---	---	---	<0.041	---	---
Benzo(a)pyrene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.049	---	---	---	<0.063	---	---	---	---	---	<0.056	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.026	---	---	---	**0.063 J**	---	---	---	---	---	<0.029	---	---
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.039	---	---	---	<0.049	---	---	---	---	---	<0.044	---	---
Chrysene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.028	---	---	---	**0.069 J**	---	---	---	---	---	<0.032	---	---
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.023	---	---	---	<0.029	---	---	---	---	---	<0.026	---	---
Fluoranthene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.018	---	---	---	<0.024	---	---	---	---	---	<0.021	---	---
Fluorene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.026	---	---	---	<0.033	---	---	---	---	---	<0.029	---	---
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.033	---	---	---	**0.313 J**	---	---	---	---	---	<0.038	---	---
Naphthalene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.028	---	---	---	<0.036	---	---	---	---	---	<0.032	---	---
Phenanthrene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.033	---	---	---	<0.043	---	---	---	---	---	<0.038	---	---
Pyrene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.118	---	---	---	<0.151	---	---	---	---	---	<0.135	---	---
Other Parameters																													
Chlorides	**7,617**	**3,060**	**5,522**	**5,620**	**5,160**	**4,700**	**1,869**	**2,300**	**1,558**	**1,540**	**1,573**	**2,310**	**5,287**	**2,680**	**4,361**	**2,040**	**2,121**	---	**4,006**	**2,250**	**2,138**	---	**2,432**	**2,800**	**3,812**	**1,490**	**3,099**	---	**3,053**
Total Moisture (%)	**78.6**	**77.3**	**77.0**	**80.8**	**85.6**	**83.2**	**40.6**	**61.4**	**50.0**	**57.6**	**51.0**	**64.8**	**68.6**	**69.6**	**67.9**	**69.4**	**61.1**	**61.1**	**64.8**	**66.0**	**69.6**	**71.0**	**61.8**	**65.4**	**65.9**	**64.9**	**65.8**	**67.9**	**67.9**
Total Organic Carbon (%)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**5.3**	---	---	---	**3.61**	---	---	---	---	---	**5.5**	---	---
AVS÷ ∑ SEM (µmol/g)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	**18.36**	---	---	---	---	---	**27.94**	---	---

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Table 1R
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																											
Sample ID	SED-12	SED-13	SED-13	SED-13	SED-13	SED-14	SED-14	SED-15	SED-15	SED-15	SED-115	SED-15	SED-16	SED-16	SED-17	SED-17	SED-18	SED-18	SED-19	SED-19	SED-19	SED-19	SED-20	SED-20	SED-21	SED-21	SED-22	SED-22
Sample Depth (ft bgs)	0-2	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-0.5	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-2	0-2	0-2	0-2
Sample Date	2/25/10	2/26/10	2/26/10	5/6/10	5/6/10	2/26/10	2/26/10	2/26/10	2/26/10	5/6/10	5/6/10	5/6/10	2/26/10	2/26/10	2/26/10	2/26/10	2/26/10	2/26/10	2/26/10	2/26/10	5/6/10	5/6/10	2/26/10	2/26/10	2/26/10	2/26/10	2/26/10	2/26/10
Sampler	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON
Total Metals																												
Arsenic	**3.8**	**4.47 B**	**4.32**	**5.018 B**	**3.11**	**3.56 B**	**3.33**	**6.01**	**3.09**	**6.748**	**4.815 B**	**2.76**	**5.24 B**	**5.09**	**4.42 B**	**3.31**	**6.91**	**5.48**	**4.89**	**4.74**	**3.704 B**	**2.3**	**4.77 B**	**5.11**	**3.47 B**	**3.61**	**4.58 B**	**3.14**
Barium	**933**	**632**	**773**	**909**	**586**	**1,021**	**1,180**	**1,777**	**2,670**	**943**	**781**	**470**	**324**	**270**	**1,729**	**1,720**	**2,139**	**1,430**	**4,887**	**2,610**	**509**	**516**	**804**	**686**	**486**	**578**	**824**	**639**
Cadmium	---	---	---	<0.030	<0.499	---	---	**0.43 B**	**1.07**	<0.034	<0.030	<0.497	---	---	---	---	---	---	<0.02	---	<0.038	<0.497	---	---	---	---	---	---
Chromium	---	---	---	**18.5**	**15.7**	---	---	**297.18**	**501**	**18**	**17.1**	**12.3**	---	---	---	---	---	---	**17.57**	---	**20.5**	**13.8**	---	---	---	---	---	---
Lead	---	---	---	**22**	**18.1**	---	---	**130.8**	**179**	**23.7**	**22.4**	**16.7**	---	---	---	---	---	---	**37.57**	---	**23.4**	**17.0**	---	---	---	---	---	---
Mercury	**0.128**	**0.07**	**0.231**	0.105 U	<0.1	**0.07**	**0.103**	**0.61**	**1.04**	**0.167**	**0.148**	**0.235**	**0.09**	**0.604**	**0.07**	**0.145**	**0.12**	**0.15**	**0.21**	**0.22**	0.176 U	**0.16**	**0.08**	**0.189**	**0.04**	<0.1	**0.07**	<0.1
Selenium	<1.99	**1.65 B**	<1.99	<0.909	<2.0	**1.42 B**	<1.99	**1.02 B**	<2	<1.016	<0.926	<1.99	**2.11 B**	<1.99	**1.52 B**	<2	**1.58 B**	<1.98	**0.90 B**	<1.99	<1.157	<1.99	**1.24 B**	<2	**1.17 B**	<1.98	**1.54 B**	<1.99
Strontium	---	---	---	**55.3**	**49.4**	---	---	**136.01**	**160**	**65.4**	**53.0**	**40.3**	---	---	---	---	---	---	**116.95**	---	**58.3**	**47.4**	---	---	---	---	---	---
Zinc	---	---	---	**65.1**	**61.4**	---	---	---	---	**73.2**	**65.9**	**51.3**	---	---	---	---	---	---	---	---	**70.4**	**57.1**	---	---	---	---	---	---
Polycyclic Aromatic Hydrocarbons																												
2-Methylnaphthalene	---	---	---	<0.065	---	---	---	---	---	<0.069	<0.067	---	---	---	---	---	---	---	---	---	<0.083	---	---	---	---	---	---	---
Acenaphthene	---	---	---	<0.069	---	---	---	---	---	<0.073	<0.070	---	---	---	---	---	---	---	---	---	<0.088	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	<0.040	---	---	---	---	---	<0.045	<0.041	---	---	---	---	---	---	---	---	---	<0.051	---	---	---	---	---	---	---
Anthracene	---	---	---	<0.044	---	---	---	---	---	<0.045	<0.044	---	---	---	---	---	---	---	---	---	<0.056	---	---	---	---	---	---	---
Benzo(a)anthracene	---	---	---	<0.051	---	---	---	---	---	<0.057	<0.052	---	---	---	---	---	---	---	---	---	<0.065	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	<0.069	---	---	---	---	---	<0.077	<0.070	---	---	---	---	---	---	---	---	---	<0.088	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	<0.036	---	---	---	---	---	<0.041	<0.037	---	---	---	---	---	---	---	---	---	<0.046	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	<0.055	---	---	---	---	---	<0.061	<0.056	---	---	---	---	---	---	---	---	---	<0.069	---	---	---	---	---	---	---
Chrysene	---	---	---	<0.040	---	---	---	---	---	<0.045	<0.041	---	---	---	---	---	---	---	---	---	<0.051	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	<0.033	---	---	---	---	---	<0.036	<0.033	---	---	---	---	---	---	---	---	---	<0.042	---	---	---	---	---	---	---
Fluoranthene	---	---	---	<0.026	---	---	---	---	---	<0.029	<0.027	---	---	---	---	---	---	---	---	---	<0.034	---	---	---	---	---	---	---
Fluorene	---	---	---	<0.036	---	---	---	---	---	<0.040	<0.037	---	---	---	---	---	---	---	---	---	<0.046	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	---	<0.047	---	---	---	---	---	<0.053	<0.048	---	---	---	---	---	---	---	---	---	<0.060	---	---	---	---	---	---	---
Naphthalene	---	---	---	<0.040	---	---	---	---	---	<0.045	<0.041	---	---	---	---	---	---	---	---	---	<0.051	---	---	---	---	---	---	---
Phenanthrene	---	---	---	<0.047	---	---	---	---	---	<0.053	<0.048	---	---	---	---	---	---	---	---	---	<0.060	---	---	---	---	---	---	---
Pyrene	---	---	---	<0.167	---	---	---	---	---	<0.187	<0.170	---	---	---	---	---	---	---	---	---	<0.213	---	---	---	---	---	---	---
Other Parameters																												
Chlorides	**1,850**	**6,429**	**4,340**	**3,542**	---	**3,950**	**3,830**	**2,161**	**1,380**	**3,837**	**3,507**	---	**6,703**	**4,440**	**3,795**	**1,880**	**5,290**	**3,270**	**2,384**	**1,870**	**5,139**	---	**3,144**	**2,540**	**3,098**	**2,150**	**5,481**	**3,240**
Total Moisture (%)	**69.9**	**73.4**	**74.9**	**72.5**	**75.6**	**71.9**	**70.7**	**53.9**	**54.6**	**75.4**	**73**	**73.5**	**81.5**	**78.6**	**69.7**	**68.0**	**74.1**	**74.5**	**64.6**	**68.8**	**78.4**	**78.7**	**69.4**	**67.2**	**68.3**	**69.8**	**68.8**	**68.3**
Total Organic Carbon (%)	---	---	---	**4.59**	---	---	---	---	---	**6.77**	**4.08**	---	---	---	---	---	---	---	---	---	**4.88**	---	---	---	---	---	---	---
AVS÷ ∑ SEM (µmol/g)	---	---	---	**81.28**	---	---	---	---	---	**93.52**	**55.09**	---	---	---	---	---	---	---	---	---	**95.94**	---	---	---	---	---	---	---

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Sed 115 is a field duplicate of Sed 15.

Table 1R
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																									
Sample ID	SED-23	SED-23	SED-24	SED-24	SED-24	SED-24	SED-25	SED-25	SED-26	SED-26	SED-26	SED-26	SED-27	SED-27	SED-28	SED-28	SED-29	SED-29	SED-30	SED-30	SED-120	SED-120	SED-31	SED-31	SED-31	SED-31	SED-32	SED-32
Sample Depth (ft bgs)	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-0.5	0-0.5	0-2	0-2	0-0.5	0-0.5	0-2	0-2
Sample Date	3/2/10	3/2/10	3/2/10	3/2/10	5/5/10	5/5/10	3/2/10	3/2/10	3/2/10	3/2/10	5/5/10	5/5/10	3/2/10	3/2/10	3/2/10	3/2/10	3/2/10	3/2/10	3/2/10	3/2/10	5/7/10	5/7/10	3/1/10	3/1/10	5/5/10	5/5/10	3/1/10	3/1/10
Sampler	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON
Total Metals																												
Arsenic	**3.76 B**	**6.73**	**4.14 B**	**4.97**	**10.479**	**3.15**	**4.13 B**	**5.95**	**4.27 B**	**4.77**	**5.127**	**3.28**	**3.30 B**	**4.95**	**3.27 B**	**5.04**	<1.06	**4.47**	**3.60 B**	**4.97**	**3.657 B**	**5.69**	**1.16 B**	**3.13**	**8.031**	**4.8**	**2.21 B**	**4.47**
Barium	**1,234**	**888**	**885**	**706**	**1,198**	**434**	**1,449**	**1,070**	**1,086**	**791**	**538**	**406**	**584**	**548**	**486**	**495**	**659**	**539**	**856**	**493**	**754**	**410**	**544**	**585**	**1,097**	**554**	**473**	**460**
Cadmium	---	---	---	---	0.026 BU	<0.499	---	---	---	---	<0.026	<0.497	---	---	**0.22 B**	<0.498	**0.11 B**	<0.496	**0.27 B**	<0.496	0.217 BU	<0.498	---	---	0.059 BU	<0.497	---	---
Chromium	---	---	---	---	**14.8**	**12.7**	---	---	---	---	**17.2**	**11.6**	---	---	**6.54**	**17.5**	**13.7**	**16.9**	**26.76**	**17**	**35.8**	**9.14**	---	---	**17**	**12.9**	---	---
Lead	---	---	---	---	**25.2**	**18.0**	---	---	---	---	**23.1**	**16.7**	---	---	**19.44**	**17.9**	**20.19**	**16.3**	**32.37**	**16.6**	**34**	**8.16**	---	---	**24.8**	**18.5**	---	---
Mercury	**0.07**	<0.1	**0.11**	<0.1	0.111 U	<0.1	**0.08**	<0.1	**0.32**	**0.454**	**0.159**	**0.314**	**0.08**	<0.1	**0.61**	**1.21**	**0.11**	<0.1	**0.08 B**	<0.1	**0.411**	<0.1	**0.04**	**0.116 J**	**0.159**	**0.115**	**0.04**	**0.132 J**
Selenium	**1.61 B**	<1.98	**1.72 B**	<1.98	<0.749	<1.99	**1.56 B**	<1.99	**0.84 B**	<1.99	<0.796	<1.99	**0.97 B**	<1.98	<1.17	<1.99	<1.20	<1.98	<1.80	<1.98	<1.429	<1.99	**0.88 B**	<1.99	<0.781	<1.99	**0.93 B**	<1.99
Strontium	---	---	---	---	**68.9**	**41.5**	---	---	---	---	**53.8**	**44.2**	---	---	**292.99**	**237**	**213.94**	**223**	**380.58**	**220**	**442.3**	**313.0**	---	---	**63.1**	**43.6**	---	---
Zinc	---	---	---	---	**62.0**	**50.3**	---	---	---	---	**64.0**	**50.7**	---	---	---	---	---	---	---	---	**414.3**	**62.1**	---	---	**64.7**	**49.7**	---	---
Polycyclic Aromatic Hydrocarbons																												
2-Methylnaphthalene	---	---	---	---	<0.051	---	---	---	---	---	<0.057	---	---	---	---	---	---	---	---	---	<0.103	---	---	---	<0.056	---	---	---
Acenaphthene	---	---	---	---	<0.054	---	---	---	---	---	<0.061	---	---	---	---	---	---	---	---	---	<0.109	---	---	---	<0.059	---	---	---
Acenaphthylene	---	---	---	---	<0.033	---	---	---	---	---	<0.035	---	---	---	---	---	---	---	---	---	<0.063	---	---	---	<0.034	---	---	---
Anthracene	---	---	---	---	<0.033	---	---	---	---	---	<0.038	---	---	---	---	---	---	---	---	---	<0.069	---	---	---	<0.034	---	---	---
Benzo(a)anthracene	---	---	---	---	<0.042	---	---	---	---	---	<0.045	---	---	---	---	---	---	---	---	---	<0.080	---	---	---	<0.044	---	---	---
Benzo(a)pyrene	---	---	---	---	<0.057	---	---	---	---	---	<0.061	---	---	---	---	---	---	---	---	---	<0.109	---	---	---	<0.059	---	---	---
Benzo(b)fluoranthene	---	---	---	---	<0.030	---	---	---	---	---	<0.032	---	---	---	---	---	---	---	---	---	<0.057	---	---	---	<0.031	---	---	---
Benzo(k)fluoranthene	---	---	---	---	<0.045	---	---	---	---	---	<0.048	---	---	---	---	---	---	---	---	---	<0.086	---	---	---	<0.047	---	---	---
Chrysene	---	---	---	---	**0.036 J**	---	---	---	---	---	<0.035	---	---	---	---	---	---	---	---	---	<0.063	---	---	---	<0.034	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	<0.027	---	---	---	---	---	<0.029	---	---	---	---	---	---	---	---	---	<0.052	---	---	---	<0.028	---	---	---
Fluoranthene	---	---	---	---	<0.021	---	---	---	---	---	<0.023	---	---	---	---	---	---	---	---	---	<0.042	---	---	---	<0.023	---	---	---
Fluorene	---	---	---	---	<0.030	---	---	---	---	---	<0.032	---	---	---	---	---	---	---	---	---	**0.920 J**	---	---	---	<0.031	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	---	---	<0.039	---	---	---	---	---	<0.041	---	---	---	---	---	---	---	---	---	<0.074	---	---	---	<0.041	---	---	---
Naphthalene	---	---	---	---	<0.033	---	---	---	---	---	<0.035	---	---	---	---	---	---	---	---	---	<0.063	---	---	---	<0.034	---	---	---
Phenanthrene	---	---	---	---	**0.048 J**	---	---	---	---	---	<0.041	---	---	---	---	---	---	---	---	---	<0.074	---	---	---	<0.041	---	---	---
Pyrene	---	---	---	---	<0.138	---	---	---	---	---	<0.146	---	---	---	---	---	---	---	---	---	<0.263	---	---	---	<0.144	---	---	---
Other Parameters																												
Chlorides	**2,763**	**2,390**	**2,902**	**1,970**	**2,482**	---	**4,162**	**2,830**	**2,378**	**1,680**	**2,869**	---	**5,591**	**2,910**	**9,299**	**5,280**	**10,144**	**8,310**	**16,043**	**7,900**	**10,400**	---	**9,286**	**6,120**	**2,469**	---	**6,797**	**3,250**
Total Moisture (%)	**64.6**	**67.9**	**65.2**	**58.2**	**66.6**	**68.9**	**66.6**	**66.6**	**65.3**	**61.6**	**68.6**	**70.5**	**72.1**	**72.9**	**78.6**	**76.7**	**79.2**	**83.4**	**86.1**	**81.1**	**82.5**	**82.2**	**70.6**	**70.1**	**68**	**67.9**	**71.9**	**72.3**
Total Organic Carbon (%)	---	---	---	---	**4.56**	---	---	---	---	---	**9.45**	---	---	---	---	---	---	---	---	---	**28.4**	---	---	---	**5.41**	---	---	---
AVS÷ ∑ SEM (µmol/g)	---	---	---	---	**47.77**	---	---	---	---	---	**19.41**	---	---	---	---	---	---	---	---	---	**1.02**	---	---	---	**6.83**	---	---	---

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Sed 120 (May 2010) corresponds to Sed 30 (March 2010).

Table 1R
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																							
Sample ID	SED-33	SED-33	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS8	SS9	SS10	SS10	SS11	SS12	SS13	SS14	SS15	B4	B5	B9	B12	B14	B17
Sample Depth (ft bgs)	0-2	0-2	0-2.1	0-1	0-0.6	0-0.6	0-2.15	0-1.65	0-1.4	0-2	0-2	0-1.7	0-2	0-2	0-2.5	0-3.7	0-1	0-0.8	0-3	0-1	0-1.5	0-0.5	0-1.5	0-1	0-3
Sample Date	3/1/10	3/1/10	4/25/06	4/25/06	4/25/06	4/26/06	4/26/06	4/26/06	4/26/06	2/26/10	2/26/10	4/27/06	2/26/10	2/26/10	4/27/06	4/27/06	4/28/06	4/28/06	4/28/06	8/9/06	8/9/06	8/9/06	8/10/06	8/10/06	8/10/06
Sampler	MPA	ICON	ICON	ICON	ICON	ICON	ICON	ICON	ICON	MPA	ICON	ICON	MPA	ICON	ICON	ICON	ICON	ICON	ICON	ICON	ICON	ICON	ICON	ICON	ICON
Total Metals																									
Arsenic	**2.60 B**	**3.21**	---	---	**8.79**	---	**11.4**	---	**22**	**7.89**	**8.12**	---	**6.52**	**8.03**	**5.28**	**6.17**	---	---	---	**40.4**	**22.6**	**27.6**	---	---	**40.8**
Barium	**670**	**395**	---	---	**1,600**	---	**7,450**	---	**15,700**	**1,042**	**871**	---	**997**	**843**	**2,750**	**2,030**	---	---	---	**631**	---	**368**	---	---	**2,390**
Cadmium	---	---	---	---	---	---	---	---	---	**0.17 B**	**0.538**	---	**0.31 B**	**0.519**	---	---	---	---	---	**0.77**	---	**0.644**	---	---	**1.24**
Chromium	---	---	---	---	**17.9**	---	**21.8**	---	**20.0**	**4.96**	**15.8**	---	**4.64**	**14.7**	**25.1**	**12.7**	---	---	---	---	---	---	---	---	**62.6**
Lead	---	---	---	---	**28.8**	---	**117**	---	**67.5**	**35.18**	**24.5 J**	---	**23.31**	**28.3**	**63.6**	**49.9**	---	---	---	**28.7**	---	**23.1**	---	---	**64.6**
Mercury	**0.08**	<0.1	---	---	---	---	---	---	---	**1.63**	**0.86**	---	**0.15**	**0.276**	---	---	---	---	---	---	---	---	---	---	---
Selenium	<1.25	<1.99	---	---	---	---	---	---	---	**1.14 B**	<2.0	---	**1.32 B**	**<1.99**	---	---	---	---	---	<4.72	---	<4.01	---	---	<10.5
Strontium	---	---	---	---	**74.3**	---	**140**	---	**231**	**74.52**	**65.3**	---	**61.26**	**65.3**	**64.8**	**72.9**	---	---	---	**59.3**	---	**64.1**	---	---	---
Zinc	---	---	---	---	**92.5**	---	**174**	---	**111**	---	---	---	---	---	**194**	**73.5**	---	---	---	---	---	---	---	---	---
Polycyclic Aromatic Hydrocarbons																									
2-Methylnaphthalene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Acenaphthene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Anthracene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Benzo(a)anthracene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Chrysene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Fluoranthene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Fluorene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Naphthalene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Phenanthrene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Pyrene	---	---	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---
Other Parameters																									
Chlorides	**14,200**	**8,170**	**1,950**	**1,600**	**825**	**3,850**	**1,430**	**1,700**	**2,050**	---	---	**1,500**	---	---	**540**	**610**	**1,900**	**2,250**	**1,400**	**10,000**	**5,800**	**7,390**	**7,360**	**2,750**	**7,950**
Total Moisture (%)	**80.0**	**73.4**	**62.6**	**53.5**	**62.7**	**75**	**57.5**	**70.8**	**71.7**	**63.9**	**64.0**	**61.7**	**69.8**	**67.2**	**29.2**	**45.8**	**65.8**	**43.9**	**64.3**	**78.4**	**71.0**	**74.4**	**76.8**	**50.2**	**81**
Total Organic Carbon (%)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AVS÷ ∑ SEM (µmol/g)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Table 1R
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field					Background														
Sample ID	B21	AB13	MPA-AB13	MPA-AB13	AB14	AB1	AB2	AB3	AB4	SED-BK-01	SED-BK-01	SED-BK-02	SED-BK-02	SED-BK-03	SED-BK-03	SED-BK-04	SED-BK-04	SED-BK-05	SED-BK-05	SED-BK-06
Sample Depth (ft bgs)	0-2	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date	8/10/06	11/13/06	5/20/10	5/20/10	11/13/06	11/13/06	11/13/06	11/13/06	11/13/06	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/11/2010	5/10/2010	5/10/2010
Sampler	ICON	ICON	MPA	ICON	ICON	ICON	ICON	ICON	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA
Total Metals																				
Arsenic	---	**12.9**	**11.5**	**5.41**	**5.51**	**7.66**	**7.64**	**6.5**	**10**	**1.041 BJ**	**4.99**	**4.167 B**	**4.26**	**4.514 B**	**2.83**	**3.874 B**	**4.79**	**2.369 B**	**6.32**	**3.255 B**
Barium	---	**551**	---	---	**200**	**257**	**247**	**279**	**227**	**155 JH**	**897**	**288**	**317**	**347**	**319**	**582**	**388**	**388**	**388**	**768**
Cadmium	---	**0.447**	---	---	**0.219**	**0.406**	**0.316**	**0.312**	**0.356**	<0.026	<0.496	<0.025	<0.495	**0.049 B**	<0.500	**0.099 B**	<0.497	<0.026	<0.499	<0.028
Chromium	---	**7.73**	---	---	**12.8**	**12.9**	**12.4**	**14.5**	**9.02**	**13.123**	**11.7**	**14.732**	**12.5**	**17.986**	**13.4**	**13.242**	**11.5**	**7.2**	**8.26**	**19.866**
Lead	---	**8.11**	---	---	**14.4**	**17.8**	**15.7**	**21**	**12.6**	**11.546**	**12.6**	**18.452**	**17.9**	**22.257**	**17.0**	**20.275**	**17.6**	**7.846**	**8.21**	**26.846**
Mercury	---	---	---	---	---	---	---	---	---	0.104 JU	<0.1	0.095 U	**0.132**	0.08 U	<0.1	**0.096**	<0.1	0.077 U	<0.1	0.094 U
Selenium	---	---	---	---	---	---	---	---	---	<0.789	<1.98	<0.744	<1.98	<0.868	<2.00	<0.687	<1.99	<0.769	<1.99	<0.839
Strontium	---	**459**	---	---	**121**	**106**	**87.2**	**63.9**	**100**	**69.401**	**80.5**	**44.643**	**44.4**	**45.833**	**37.4**	**41.758**	**38.5**	**84.308**	**129**	**59.396**
Zinc	---	**24.8**	---	---	**63.9**	**46.4**	**45.9**	**46.8**	**40.9**	**30.978**	**23.4**	**46.131**	**46.6**	**58.333**	**48.3**	**42.857**	**42.9**	**21.508**	**19.3**	**64.765**
Polycyclic Aromatic Hydrocarbons																				
2-Methylnaphthalene	---	---	---	---	---	---	---	---	---	<0.057	---	<0.051	---	<0.063	---	<0.047	---	<0.055	---	<0.057
Acenaphthene	---	---	---	---	---	---	---	---	---	<0.060	---	<0.054	---	<0.066	---	<0.049	---	<0.058	---	<0.060
Acenaphthylene	---	---	---	---	---	---	---	---	---	<0.035	---	<0.033	---	<0.038	---	<0.030	---	<0.034	---	<0.037
Anthracene	---	---	---	---	---	---	---	---	---	<0.038	---	<0.033	---	<0.038	---	<0.030	---	<0.034	---	<0.037
Benzo(a)anthracene	---	---	---	---	---	---	---	---	---	<0.044	---	<0.042	---	<0.049	---	<0.038	---	<0.043	---	<0.047
Benzo(a)pyrene	---	---	---	---	---	---	---	---	---	<0.060	---	<0.057	---	<0.066	---	<0.052	---	<0.058	---	<0.064
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---	---	<0.032	---	<0.030	---	<0.035	---	<0.027	---	<0.031	---	<0.034
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---	---	<0.047	---	<0.045	---	<0.052	---	<0.041	---	<0.046	---	<0.050
Chrysene	---	---	---	---	---	---	---	---	---	<0.035	---	<0.033	---	<0.038	---	<0.030	---	<0.034	---	<0.037
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---	---	<0.028	---	<0.027	---	<0.031	---	<0.025	---	<0.028	---	<0.030
Fluoranthene	---	---	---	---	---	---	---	---	---	<0.023	---	<0.021	---	<0.025	---	<0.020	---	<0.022	---	<0.024
Fluorene	---	---	---	---	---	---	---	---	---	<0.032	---	<0.030	---	<0.035	---	<0.027	---	<0.031	---	<0.033
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---	---	<0.041	---	<0.039	---	<0.045	---	<0.036	---	<0.040	---	<0.044
Naphthalene	---	---	---	---	---	---	---	---	---	<0.035	---	<0.033	---	<0.038	---	<0.030	---	<0.034	---	<0.037
Phenanthrene	---	---	---	---	---	---	---	---	---	<0.041	---	<0.039	---	<0.045	---	<0.036	---	<0.040	---	<0.044
Pyrene	---	---	---	---	---	---	---	---	---	<0.145	---	<0.137	---	<0.160	---	<0.126	---	<0.142	---	<0.154
Other Parameters																				
Chlorides	**3,700**	**73,800**	---	---	**15,500**	**10,500**	**10,000**	**10,800**	**13,800**	**1,139**	---	**1,750**	---	**1,024**	---	**687**	---	**1,406**	---	**3,826**
Total Moisture (%)	**76.4**	**86.0**	---	---	**62.8**	**81.9**	**85.6**	**82.8**	**86.1**	**68.3**	**72.3**	**66.4**	**71.5**	**71.2**	**72.2**	**63.6**	**68.4**	**67.5**	**77.9**	**70.2**
Total Organic Carbon (%)	---	---	---	---	---	---	---	---	---	**18.4**	---	**5.15**	---	**1.44**	---	**4.27**	---	**17.2**	---	**5.5**
AVS÷ ∑ SEM (µmol/g)	---	---	---	---	---	---	---	---	---	**0.34**	---	**64.52**	---	**89.39**	---	**41.82**	---	**4.23**	---	**15.79**

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Table 1R
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Background										
Sample ID	SED-BK-06	SED-BK-07	SED-BK-07	SED-BK-08	SED-BK-08	SED-BK-09	SED-BK-09	SED-BK-10	SED-BK-10	SED-BK-11	SED-BK-11
Sample Depth (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date	5/10/2010	5/11/2010	5/10/2010	5/11/2010	5/10/2010	5/11/2010	5/10/2010	5/19/2010	5/10/2010	5/19/2010	5/10/2010
Sampler	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON
Total Metals											
Arsenic	**4.33**	**3.930 B**	**2.16**	**4.711 B**	**5.98**	**8.471**	**9.45**	**4.86 B**	**6.79**	**9.95**	**---**
Barium	**753**	**463**	**397**	**383**	**313**	**264**	**231**	**274**	**205**	**319**	**---**
Cadmium	<0.497	<0.036	<0.497	<0.034	<0.498	<0.034	<0.497	<0.0331	<0.499	<0.042	**---**
Chromium	**15.1**	**18.166**	**14.3**	**17.727**	**12.2**	**11.736**	**10.2**	**23.3**	**12.9**	**18.59**	**---**
Lead	**18.7**	**23.057**	**18.6**	**24.05**	**17.3**	**11.446**	**11.0**	**27.2**	**13.8**	**21.26**	**---**
Mercury	<0.1	**0.568**	**0.185**	**0.14**	<0.1	0.083 U	<0.1	<0.011	<0.1	<0.014	**---**
Selenium	<1.99	<1.092	<1.99	<1.033	<1.99	<1.033	<1.99	<0.996	<1.99	<1.26	**---**
Strontium	**52.0**	**61.135**	**50.5**	**64.463**	**47.8**	**84.711**	**84.6**	**103**	**62.8**	**100**	**---**
Zinc	**48.4**	**68.996**	**61.6**	**58.264**	**44.1**	**16.446**	**29.3**	**205 J**	**43.9**	**90.9**	**---**
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	---	<0.074	---	<0.074	---	<0.070	---	<0.068	---	<0.086	---
Acenaphthene	---	<0.079	---	<0.079	---	<0.074	---	<0.072	---	<0.091	---
Acenaphthylene	---	<0.048	---	<0.045	---	<0.045	---	<0.044	---	<0.056	---
Anthracene	---	<0.048	---	<0.045	---	<0.045	---	<0.044	---	<0.056	---
Benzo(a)anthracene	---	<0.061	---	<0.058	---	<0.058	---	<0.056	---	<0.071	---
Benzo(a)pyrene	---	<0.083	---	<0.079	---	<0.079	---	<0.076	---	<0.096	---
Benzo(b)fluoranthene	---	<0.044	---	<0.041	---	<0.041	---	<0.040	---	<0.051	---
Benzo(k)fluoranthene	---	<0.066	---	<0.062	---	<0.062	---	<0.060	---	<0.076	---
Chrysene	---	<0.048	---	<0.045	---	<0.045	---	<0.044	---	<0.056	---
Dibenz(a,h)anthracene	---	<0.039	---	<0.037	---	<0.037	---	<0.0356	---	<0.0452	---
Fluoranthene	---	<0.031	---	<0.030	---	<0.030	---	<0.029	---	<0.036	---
Fluorene	---	<0.043	---	<0.041	---	<0.041	---	<0.0397	---	<0.0504	---
Indeno(1,2,3-cd)pyrene	---	<0.057	---	<0.054	---	<0.054	---	<0.052	---	<0.066	---
Naphthalene	---	<0.048	---	<0.045	---	<0.045	---	<0.044	---	<0.056	---
Phenanthrene	---	<0.057	---	<0.054	---	<0.054	---	<0.052	---	<0.066	---
Pyrene	---	<0.201	---	<0.190	---	<0.190	---	<0.183	---	<0.232	---
Other Parameters											
Chlorides	---	**961**	---	**1,950**	---	**1,054**	---	**2,382**	---	**1,626**	---
Total Moisture (%)	**64.1**	**77.1**	**79.6**	**75.8**	**71.0**	**75.8**	**75.5**	**74.9**	**65.1**	**80.2**	**---**
Total Organic Carbon (%)	---	**6.6**	---	**5.88**	---	**10.6**	---	**13.4**	---	**19.5**	---
AVS÷ ∑ SEM (µmol/g)	---	**45.26**	---	**67.54**	---	**0.30**	---	**0.23**	---	**1.35**	---

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Table 3R
Sediment Screening (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field				Background					Sediment Quality Guideline	
	Detection	Maximum	Arithmetic Mean	95% UCL	Detection	Maximum	Arithmetic Mean	std dev	Arithmetic Mean + Standard Deviation	ERL	ERM
Total Metals											
Arsenic	46/46	40.8	8.03	13.6	15/15	10	5.95	2.45	8.40	8.2	70
Arsenic (1)	44/44	22.0	5.82	6.68	15/15	10	5.95	2.45	8.40	8.2	70
Barium	45/45	15,700	1,364	2,967	15/15	761	359	144	503	--	--
Cadmium	15/25	1.655	0.413	0.51	6/15	0.406	0.274	0.077	0.351	1.2	9.6
Chromium	29/29	399.1	22.53	52.35	15/15	18.6	13.80	3.17	16.97	81	370
Lead	31/31	154.9	32.23	51.01	15/15	22.77	17.41	4.45	21.86	46.7	218
Mercury (3)	35/35	7.59	0.413	1.35	4/11	0.377	0.113	0.092	0.205	0.15	0.71
Mercury (2)(3)	35/35	1.245	0.221	0.418	4/11	0.377	0.113	0.092	0.205	0.15	0.71
Selenium	21/35	2.11	1.15	1.221	0/11	---	---	---	---	--	--
Strontium	30/30	377.6	108	186.3	15/15	107	73.4	23.8	97.2	--	--
Zinc	17/17	238.2	87.42	149.6	15/15	124.5	52.1	26.4	78.5	150	410
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	0/15	<0.103	---	---	0/11	<0.086	---	---	---	---	---
Acenaphthene	0/15	<0.109	---	---	0/11	<0.091	---	---	---	---	---
Acenaphthylene	0/15	<0.063	---	---	0/11	<0.056	---	---	---	---	---
Anthracene	0/15	<0.069	---	---	0/11	<0.056	---	---	---	---	---
Benzo(a)anthracene	0/15	<0.080	---	---	0/11	<0.071	---	---	---	---	---
Benzo(a)pyrene	0/15	<0.109	---	---	0/11	<0.096	---	---	---	---	---
Benzo(b)fluoranthene	1/15	<0.057	0.039	---	0/11	<0.051	---	---	---	---	---
Benzo(k)fluoranthene	0/15	<0.086	---	---	0/11	<0.076	---	---	---	---	---
Chrysene	2/15	<0.063	0.043	0.047	0/11	<0.056	---	---	---	---	---
Dibenz(a,h)anthracene	0/15	<0.052	---	---	0/11	<0.0452	---	---	---	---	---
Fluoranthene	0/15	<0.042	---	---	0/11	<0.036	---	---	---	---	---
Fluorene	1/15	0.92	0.122	---	0/11	<0.0504	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	1/15	<0.074	0.074	---	0/11	<0.066	---	---	---	---	---
Naphthalene	0/15	<0.063	---	---	0/11	<0.056	---	---	---	---	---
Phenanthrene	1/15	<0.074	0.048	---	0/11	<0.066	---	---	---	---	---
Pyrene	0/15	<0.263	---	---	0/11	<0.232	---	---	---	---	---
Total LPAHs	---	1.401	0.421	0.902	---	0.461	0.338	0.064	0.401	---	---
Total HPAHs	---	0.826	0.552	0.646	---	0.729	0.531	0.102	0.633	---	---
Total PAHs	---	2.227	0.973	1.252	---	1.191	0.868	0.166	1.034	4.022	44.792
Other Parameters											
Chlorides	55/55	15,500	5,381	6,065	15/15	13,800	4,194	4,552	8,746	---	---
Total Moisture (%)	57/57	84.4	67.8	70.18	15/15	86.1	75.4	6.7	82.1	---	---
Total Organic Carbon (%)	10/10	28.4	8.0	18.0	11/11	19.5	9.8	6.4	16.2	---	---
AVS÷ ∑ SEM (µmol/g)	9/9	95.94	41.43	63.02	11/11	89.4	30.1	32.9	63.0	---	---

Notes:

AVS - acid volatile sulfides
DW - dry weight
ERL - Effects Range-Low for marine/estuarine sediments (Long *et al.* 1995)
ERM - Effects Range-Median for marine/estuarine sediments (Long *et al.* 1995)
HPAH - high molecular weight PAH
LPAH - low molecular weight PAH
PAH - polycyclic aromatic hydrocarbon
SEM - simultaneously extracted metals
UCL - upper confidence limit
WW - wet weight

Results from 2010 split samples were averaged for the above statistics.

(1) Excludes arsenic re-run laboratory data and ICON archived sediment samples (see ICON Table 4-1R).

(2) Excludes sample collected by ICON @ SD-06 on 02/25/10 (14.3 mg/kg DW mercury). The corresponding split sample had a mercury concentration of 0.88 mg/kg DW. Michael Pisani & Associates resampled SD-06 and the surrounding area in October 2010. The preliminary laboratory results indicate that all mercury concentrations are below 1.0 mg/kg WW.

(3) Sferra et al (1999) performed a site-specific evaluation of mercury toxicity in sediment for the Calcasieu River estuary. Sferra et al determined that a site-specific threshold for mercury toxicity to amphipods exceeded 4.1 mg/kg DW (the highest concentration tested) due to relatively high levels of sulfides (i.e,. AVS/SEM ratios well above 1) and total organic carbon (5-6%) in site sediment. The authors also cited several other studies that found a site-specific absence of toxicity to benthic invertebrates at mercury levels exceeding sediment quality guidelines. Those authors hypothesized that relatively high total organic carbon and sulfide levels could account for the lack of bioavailability. As shown above, similarly high TOC and AVS/SEM levels are present at the Site, thereby indicating that mercury in Site sediment is not toxic to benthic invertebrates.

Table 4R
Surface Water Analytical Data (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																			
Sample ID	SW-01	SW-01	SW-02	SW-02	SW-03	SW-03	SW-04	SW-04	SW-05	SW-05	SW-06	SW-06	SW-07	SW-07	SW-09	SW-109	SW-09	SW-10	SW-10	SW-20	SW-20
Sample Date	5/6/2010	5/6/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/7/2010	5/7/2010
Sampler	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	MPA	ICON	MPA	ICON	MPA	ICON
Total Metals (Total Recoverable)																					
Arsenic	<0.00079	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	**0.0019 B**	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	<0.00079	<0.00079	<0.0100	<0.00079	<0.0100	**0.013**	--
Barium	**0.28**	**0.284**	**0.29**	**0.285**	**0.3**	**0.262**	**0.27**	**0.245**	**0.29**	**0.265**	**0.39**	**0.346**	**0.45**	**0.413**	**0.42**	**0.41**	**0.378**	**0.38**	**0.345**	**1.23**	--
Cadmium	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	--
Chromium	**0.0026 B**	<0.0100	**0.0023 B**	<0.0100	**0.0026 B**	<0.0100	**0.0022 B**	<0.0100	**0.0025 B**	<0.0100	**0.0025 B**	<0.0100	**0.0025 B**	<0.0100	**0.0027 B**	**0.0027 B**	<0.0100	**0.0022 B**	<0.0100	**0.0075 B**	--
Iron	**1.26**	--	**0.8**	--	**1.08**	--	**0.49**	--	**0.85**	--	**0.94**	--	**0.94**	--	**1.12**	**1.11**	--	**1.09**	--	**11.3**	--
Lead	<0.0015	<0.0100	<0.0015	<0.0100	<0.0015	<0.0100	<0.0015	<0.0100	<0.0015	<0.0100	<0.0015	<0.0100	<0.0015	<0.0100	<0.0015	<0.0015	<0.0100	<0.0015	<0.0100	**0.021**	--
Magnesium	**88.2**	--	**100**	--	**98.3**	--	**103**	--	**99.1**	--	**127**	--	**130**	--	**140**	**141**	--	**120**	--	**149**	--
Manganese	**0.23**	--	**0.27**	--	**0.3**	--	**0.16**	--	**0.31**	--	**0.46**	--	**0.61**	--	**0.51**	**0.5**	--	**0.48**	--	**0.83**	--
Mercury	0.00007 U	<0.000200	0.00009 U	<0.000200	0.00007 U	<0.000200	0.00009 U	<0.000200	0.00009 U	<0.000200	0.00008 U	<0.000200	0.00008 U	<0.000200	0.00011 U	0.00006 U	<0.000200	0.00007 U	<0.000200	0.0001 U	--
Selenium	<0.0037	**0.035**	<0.0037	**0.034**	<0.0037	**0.039**	<0.0037	**0.033**	<0.0037	**0.037**	<0.0037	**0.048**	<0.0037	**0.032**	<0.0037	<0.0037	**0.036**	<0.0037	**0.039**	<0.0037	--
Strontium	**0.64**	**0.554**	**0.71**	**0.637**	**0.7**	**0.558**	**0.72**	**0.614**	**0.72**	**0.602**	**0.9**	**0.729**	**0.95**	**0.778**	**0.99**	**1.01**	**0.829**	**0.86**	**0.721**	**1.74**	--
Zinc	**0.0062 B**	**0.017**	**0.0045 B**	**0.013**	<0.004	**0.015**	<0.004	**0.012**	<0.004	**0.012**	<0.004	**0.016**	<0.004	<0.0100	<0.004	<0.004	<0.0100	<0.004	**0.020**	**0.067**	--
Total Metals (Dissolved)																					
Arsenic	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	<0.00079	---	<0.00079	---	**0.0075 B**	---
Barium	**0.28**	---	**0.28**	---	**0.29**	---	**0.26**	---	**0.26**	---	**0.37**	---	**0.42**	---	**0.37**	**0.38**	---	**0.35**	---	**1.1**	---
Cadmium	0.00026 U	---	0.00027 U	---	<0.00016	---	0.00035 U	---	<0.00016	---	0.0002 U	---	0.00024 U	---	<0.00016	0.00027 U	---	<0.00016	---	<0.00016	---
Chromium	**0.0017 B**	---	**0.0016 B**	---	**0.0018 B**	---	**0.0017 B**	---	**0.0018 B**	---	**0.0021 B**	---	**0.002 B**	---	**0.0024 B**	**0.0022 B**	---	**0.0022 B**	---	**0.0051 B**	---
Lead	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	<0.0015	---	<0.0015	---	**0.0088**	---
Mercury	<0.000055	---	**0.00009 B**	---	**0.00009 B**	---	**0.00006 B**	---	**0.00007 B**	---	**0.0001 B**	---	**0.00009 B**	---	**0.0001 B**	**0.00006 B**	---	**0.00012 B**	---	<0.000055	---
Selenium	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	<0.0037	---	<0.0037	---	<0.0037	---
Strontium	**0.69**	---	**0.74**	---	**0.71**	---	**0.73**	---	**0.69**	---	**0.91**	---	**0.93**	---	**1**	**1.03**	---	**0.88**	---	**1.66**	---
Zinc	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	**0.0095 B**	<0.004	---	<0.004	---	**0.023**	---
Polycyclic Aromatic Hydrocarbons																					
2-Methylnaphthalene	<0.0000519	---	<0.0000527	---	<0.0000527	---	<0.0000525	---	<0.0000514	---	<0.0000522	---	<0.0000519	---	<0.0000519	<0.0000519	---	<0.0000519	---	<0.0000514	---
Acenaphthene	<0.0000137	---	<0.0000139	---	<0.0000139	---	<0.0000138	---	<0.0000135	---	<0.0000137	---	<0.0000137	---	<0.0000137	<0.0000137	---	<0.0000137	---	<0.0000135	---
Acenaphthylene	<0.0000149	---	<0.0000151	---	<0.0000151	---	<0.0000151	---	<0.0000147	---	<0.000015	---	<0.0000149	---	<0.0000149	<0.0000149	---	<0.0000149	---	<0.0000147	---
Anthracene	<0.00000918	---	<0.00000933	---	<0.00000933	---	<0.00000928	---	<0.00000909	---	<0.00000923	---	<0.00000918	---	<0.00000918	<0.00000918	---	<0.00000918	---	<0.00000909	---
Benzo(a)anthracene	<0.0000503	---	<0.0000511	---	<0.0000511	---	<0.0000508	---	<0.0000498	---	<0.0000506	---	<0.0000503	---	<0.0000503	<0.0000503	---	<0.0000503	---	<0.0000498	---
Benzo(a)pyrene	<0.0000137	---	<0.0000139	---	<0.0000139	---	<0.0000138	---	<0.0000135	---	<0.0000137	---	<0.0000137	---	<0.0000137	<0.0000137	---	<0.0000137	---	<0.0000135	---
Benzo(b)fluoranthene	<0.0000328	---	<0.0000333	---	<0.0000333	---	<0.0000331	---	<0.0000324	---	<0.0000329	---	<0.0000328	---	<0.0000328	<0.0000328	---	<0.0000328	---	<0.0000324	---
Benzo(k)fluoranthene	<0.0000223	---	<0.0000227	---	<0.0000227	---	<0.0000226	---	<0.0000221	---	<0.0000225	---	<0.0000223	---	<0.0000223	<0.0000223	---	<0.0000223	---	<0.0000221	---
Chrysene	<0.000043	---	<0.0000436	---	<0.0000436	---	<0.0000434	---	<0.0000425	---	<0.0000432	---	<0.000043	---	<0.000043	<0.000043	---	<0.000043	---	<0.0000425	---
Dibenz(a,h)anthracene	<0.0000195	---	<0.0000198	---	<0.0000198	---	<0.0000197	---	<0.0000193	---	<0.0000196	---	<0.0000195	---	<0.0000195	<0.0000195	---	<0.0000195	---	<0.0000193	---
Fluoranthene	<0.0000134	---	<0.0000136	---	<0.0000136	---	<0.0000135	---	<0.0000132	---	<0.0000134	---	<0.0000134	---	<0.0000134	<0.0000134	---	<0.0000134	---	<0.0000132	---
Fluorene	<0.0000184	---	<0.0000187	---	<0.0000187	---	<0.0000186	---	<0.0000182	---	<0.0000185	---	<0.0000184	---	<0.0000184	<0.0000184	---	<0.0000184	---	<0.0000182	---
Indeno(1,2,3-cd)pyrene	<0.0000171	---	<0.0000174	---	<0.0000174	---	<0.0000173	---	<0.000017	---	<0.0000172	---	<0.0000171	---	<0.0000171	<0.0000171	---	<0.0000171	---	<0.000017	---
Naphthalene	<0.0000283	---	<0.0000287	---	<0.0000287	---	<0.0000286	---	<0.000028	---	<0.0000284	---	<0.0000283	---	<0.0000283	<0.0000283	---	<0.0000283	---	<0.000028	---
Phenanthrene	<0.0000166	---	<0.0000169	---	<0.0000169	---	<0.0000168	---	<0.0000165	---	<0.0000167	---	<0.0000166	---	<0.0000166	<0.0000166	---	<0.0000166	---	<0.0000165	---
Pyrene	<0.0000181	---	<0.0000183	---	<0.0000183	---	<0.0000182	---	<0.0000179	---	<0.0000182	---	<0.0000181	---	<0.0000181	<0.0000181	---	<0.0000181	---	<0.0000179	---
Other Parameters																					
Bicarbonate Alkalinity (mg/L CaCO3)	---	---	---	---	---	---	---	---	---	---	60 R	---	---	---	---	**67.4**	---	---	---	---	---
Carbonate Alkalinity (mg/L CaCO3)	---	---	---	---	---	---	---	---	---	---	<0.17	---	---	---	---	<0.17	---	---	---	---	---
Calcium	**38.4**	---	**44.1**	---	**43.3**	---	**44.6**	---	**43.1**	---	**54.3**	---	**56.1**	---	**58.6**	**59.4**	---	**50.6**	---	**73.9**	---
Chloride	**1,210**	**1,530**	**1,330**	**1,560**	**1,250**	**1,490**	**1,420**	**1,530**	**1,290**	**1,630**	**1,610**	**1,920**	**1,640**	**2,130**	**1,870**	**1,840**	**2,410**	**1,610**	**2,200**	**2,220**	**2,700**
Hardness	**378**	**495**	**432**	**578**	**424**	**502**	**441**	**558**	**425**	**545**	**541**	**653**	**554**	**692**	**591**	**597**	**746**	**619**	**646**	**677**	--
Potassium	**29.2**	---	**33.3**	---	**32.7**	---	**34.4**	---	**33.1**	---	**38.6 JH**	---	**40.7**	---	**42.6**	**42.9**	---	**37.2**	---	**59.6**	---
Salinity (ppt)	**2.4**	---	---	---	---	---	---	---	---	---	---	---	---	---	**3.7**	---	---	**3.2**	---	---	---
Sodium	**631**	---	**727**	---	**771**	---	**808**	---	**769**	---	**935**	---	**981**	---	**915**	**1100**	---	**917**	---	**1230**	---
Sulfate	**105**	---	---	---	---	---	---	---	---	---	---	---	---	---	**83.9**	---	---	**106**	---	---	---
Total Dissolved Solids (TDS)	**2,710**	**2,580**	**2,900**	**2,740**	**2,780**	**2,670**	**3,050**	**2,960**	**2,880**	**2,660**	**3,800**	**3,630**	**3,590**	**3,260**	**4,220**	**4,150**	**3,450**	**3,520**	**3,220**	**4,920**	**4,820**

Notes:

B - For inorganics, result is between Reporting Limit and Method Detection Limit

JH - bias is likely high

U - not detected based on quality control criteria

SW 109 is a field duplicate of SW 09.

Table 4R
Surface Water Analytical Data (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Background																					
Sample ID	SW BK-01	SW BK-01	SW BK-02	SW BK-02	SW BK-03	SW BK-03	SW BK-04	SW BK-04	SW BK-05	SW BK-05	SW BK-06	SW BK-06	SW BK-07	SW BK-07	SW BK-08	SW BK-08	SW BK-09	SW BK-09	SW-BK-10	SW-BK-10	SW-BK-11	SW-BK-11
Sample Date	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/19/2010	5/19/2010	5/19/2010	5/19/2010
Sampler	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON	MPA	ICON
Total Metals (Total Recoverable)																						
Arsenic	<0.00079	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	**0.0024 B**	<0.0100	<0.00079	<0.0100	<0.00079	<0.0100	**0.004 B**	---	**0.0035 B**	---	**0.0054 B**	---
Barium	**0.3**	**0.282**	**0.31**	**0.276**	**0.3**	**0.279**	**0.32**	**0.297**	**0.31**	**0.301**	**0.43**	**0.375**	**0.44**	**0.415**	**0.34**	**0.315**	**0.31**	---	**0.22**	---	**0.25**	---
Cadmium	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	<0.00016	<0.00500	**0.00021 B**	<0.00500	<0.00016	---	0.00051 BU	---	0.00056 BU	---
Chromium	**0.0035 B**	<0.0100	**0.0035 B**	<0.0100	**0.0027 B**	<0.0100	**0.0038 B**	<0.0100	**0.0034 B**	<0.0100	**0.0041 B**	<0.0100	**0.0026 B**	<0.0100	**0.0046 B**	<0.0100	**0.0039 B**	---	**0.0041 B**	---	**0.004 B**	---
Iron	**0.58**	--	**0.7**	--	**0.71**	--	**0.94**	--	**0.71**	--	**1.55**	--	**1.07**	--	**1.76**	--	**1.14**	---	---	---	---	---
Lead	**0.0017 B**	<0.0100	<0.0015	<0.0100	<0.0015	<0.0100	**0.0015 B**	<0.0100	<0.0015	**0.017**	**0.0019 B**	<0.0100	<0.0015	<0.0100	**0.003 B**	<0.0100	**0.0034 B**	---	**0.0058 B**	---	**0.0042 B**	---
Magnesium	**157**	--	**166**	--	**126**	--	**161**	--	**156**	--	**244**	--	**138**	--	**162**	--	**152**	---	**52.3**	---	**76.2**	---
Manganese	**0.15**	--	**0.23**	--	**0.34**	--	**0.29**	--	**0.16**	--	**0.88**	--	**0.59**	--	**0.25**	--	**0.24**	---	---	---	---	---
Mercury	<0.000055	<0.000200	<0.000055	<0.000200	<0.000055	<0.000200	<0.000055	<0.000200	<0.000055	<0.000200	<0.000055	<0.000200	<0.000055	<0.000200	**0.00007 B**	<0.000200	<0.000055	---	<0.000055	---	<0.000055	---
Selenium	<0.0037	**0.054**	<0.0037	**0.047**	<0.0037	**0.039**	<0.0037	**0.051**	<0.0037	**0.037**	<0.0037	**0.051**	<0.0037	**0.036**	<0.0037	**0.042**	<0.0037	---	<0.0037	---	<0.0037	---
Strontium	**1.04**	**0.980**	**1.13**	**1.09**	**0.85**	**0.788**	**1.09**	**1.00**	**1.04**	**0.989**	**1.65**	**1.52**	**0.96**	**0.898**	**1.03**	**0.903**	**1.05**	---	**0.38**	---	**0.52**	---
Zinc	**0.0045 B**	**0.055**	**0.13**	**0.013**	**0.013 B**	**0.013**	**0.01 B**	**0.020**	**0.0074 B**	**0.033**	**0.0092 B**	**0.018**	<0.004	**0.022**	**0.0085 B**	**0.014**	**0.0076 B**	---	**0.013 B**	---	**0.0097 B**	---
Total Metals (Dissolved)																						
Arsenic	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	---	<0.00079	---	**0.0047 B**	---	**0.0033 B**	---	<0.00079	---	<0.00079	---	**0.003 B**	**0.011**	**0.0029 B**	**0.014**
Barium	**0.28**	---	**0.3**	---	**0.28**	---	**0.29**	---	**0.3**	---	**0.39**	---	**0.4**	---	**0.31**	---	**0.33**	---	**0.14**	**0.144**	**0.18**	**0.216**
Cadmium	<0.00016	---	<0.00016	---	<0.00016	---	<0.00016	---	<0.00016	---	<0.00016	---	<0.00016	---	<0.00016	---	<0.00016	---	**0.00086 B**	<0.00500	**0.00078 B**	<0.00500
Chromium	**0.0032 B**	---	**0.0033 B**	---	**0.0025 B**	---	**0.003 B**	---	**0.003 B**	---	**0.0036 B**	---	**0.0024 B**	---	**0.0028 B**	---	**0.003 B**	---	**0.00071 B**	<0.0100	**0.0011 B**	<0.0100
Lead	**0.0023 B**	---	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	---	**0.0021 B**	---	<0.0015	---	<0.0015	---	<0.0015	---	<0.0015	<0.0100	<0.0015	<0.0100
Mercury	**0.00006 B**	---	<0.000055	---	<0.000055	---	**0.00006 B**	---	<0.000055	---	<0.000055	---	<0.000055	---	<0.000055	---	<0.000055	---	<0.000055	<0.000200	<0.000055	<0.000200
Selenium	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	---	<0.0037	**0.024**	<0.0037	**0.032**
Strontium	**1.05**	---	**1.12**	---	**0.84**	---	**1.06**	---	**1.04**	---	**1.56**	---	**0.95**	---	**1.04**	---	**1.06**	---	**0.34**	**0.339**	**0.52**	**0.497**
Zinc	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	---	<0.004	<0.0100	<0.004	**0.011**
Polycyclic Aromatic Hydrocarbons																						
2-Methylnaphthalene	<0.0000522	---	<0.0000522	---	<0.0000525	---	<0.0000519	---	<0.0000519	---	<0.0000519	---	<0.000053	---	<0.0000519	---	<0.0000519	---	<0.0000519	---	<0.0000536	---
Acenaphthene	<0.0000137	---	<0.0000137	---	<0.0000138	---	<0.0000137	---	<0.0000137	---	**0.000131**	---	<0.000014	---	<0.0000137	---	<0.0000137	---	<0.0000137	---	<0.0000141	---
Acenaphthylene	<0.000015	---	<0.000015	---	<0.0000151	---	<0.0000149	---	<0.0000149	---	<0.0000149	---	<0.0000152	---	<0.0000149	---	<0.0000149	---	<0.0000149	---	<0.0000154	---
Anthracene	<0.00000923	---	<0.00000923	---	<0.00000928	---	<0.00000918	---	<0.00000918	---	<0.00000918	---	<0.00000938	---	<0.00000918	---	<0.00000918	---	<0.00000918	---	<0.00000947	---
Benzo(a)anthracene	<0.0000506	---	<0.0000506	---	<0.0000508	---	<0.0000503	---	<0.0000503	---	<0.0000503	---	<0.0000514	---	<0.0000503	---	<0.0000503	---	<0.0000503	---	<0.0000519	---
Benzo(a)pyrene	<0.0000137	---	<0.0000137	---	<0.0000138	---	<0.0000137	---	<0.0000137	---	<0.0000137	---	<0.000014	---	<0.0000137	---	<0.0000137	---	<0.0000137	---	<0.0000141	---
Benzo(b)fluoranthene	<0.0000329	---	<0.0000329	---	<0.0000331	---	<0.0000328	---	<0.0000328	---	<0.0000328	---	<0.0000334	---	<0.0000328	---	<0.0000328	---	<0.0000328	---	<0.0000338	---
Benzo(k)fluoranthene	<0.0000225	---	<0.0000225	---	<0.0000226	---	<0.0000223	---	<0.0000223	---	<0.0000223	---	<0.0000228	---	<0.0000223	---	<0.0000223	---	<0.0000223	---	<0.0000231	---
Chrysene	<0.0000432	---	<0.0000432	---	<0.0000434	---	<0.000043	---	<0.000043	---	<0.000043	---	<0.0000439	---	<0.000043	---	<0.000043	---	<0.000043	---	<0.0000443	---
Dibenz(a,h)anthracene	<0.0000196	---	<0.0000196	---	<0.0000197	---	<0.0000195	---	<0.0000195	---	<0.0000195	---	<0.0000199	---	<0.0000195	---	<0.0000195	---	<0.0000195	---	<0.0000201	---
Fluoranthene	<0.0000134	---	<0.0000134	---	<0.0000135	---	<0.0000134	---	<0.0000134	---	<0.0000134	---	<0.0000136	---	<0.0000134	---	<0.0000134	---	<0.0000134	---	<0.0000138	---
Fluorene	<0.0000185	---	<0.0000185	---	<0.0000186	---	<0.0000184	---	<0.0000184	---	<0.0000184	---	<0.0000188	---	<0.0000184	---	<0.0000184	---	<0.0000184	---	<0.0000189	---
Indeno(1,2,3-cd)pyrene	<0.0000172	---	<0.0000172	---	<0.0000173	---	<0.0000171	---	<0.0000171	---	<0.0000171	---	<0.0000175	---	<0.0000171	---	<0.0000171	---	<0.0000171	---	<0.0000177	---
Naphthalene	<0.0000284	---	<0.0000284	---	<0.0000286	---	<0.0000283	---	<0.0000283	---	<0.0000283	---	<0.0000289	---	<0.0000283	---	<0.0000283	---	<0.0000283	---	<0.0000292	---
Phenanthrene	<0.0000167	---	<0.0000167	---	<0.0000168	---	<0.0000166	---	<0.0000166	---	<0.0000166	---	<0.000017	---	<0.0000166	---	<0.0000166	---	<0.0000166	---	<0.0000172	---
Pyrene	<0.0000182	---	<0.0000182	---	<0.0000182	---	<0.0000181	---	<0.0000181	---	<0.0000181	---	<0.0000184	---	<0.0000181	---	<0.0000181	---	<0.0000181	---	<0.0000186	---
Other Parameters																						
Bicarbonate Alkalinity (mg/L CaCO3)	---	---	**64.6**	---	---	---	---	---	**63.5**	---	---	---	**75.1**	---	---	---	---	---	---	---	---	---
Carbonate Alkalinity (mg/L CaCO3)	---	---	<0.17	---	---	---	---	---	<0.17	---	---	---	<0.17	---	---	---	---	---	---	---	---	---
Calcium	**65.8**	---	**71.5**	---	**52.8**	---	**66.4**	---	**65.9**	---	**97.7**	---	**57**	---	**70**	---	**63.2**	---	**24.5**	---	**35.7**	---
Chloride	**2,510**	**2,910**	**2,680**	**2,770**	**2,060**	**2,060**	**2,660**	**2,560**	**2,550**	**2,340**	**3,690**	**4,400**	**2,210**	**2,410**	**2,490**	**2,700**	**2,530**	**2,910**	**834**	**852**	**1,240**	**1,140**
Hardness	**811**	--	**863**	---	**652**	---	**828**	---	**808**	---	**1,250**	---	**709**	---	**840**	---	**785**	---	**277**	---	**403**	---
Potassium	**52**	---	**54.7**	---	**42.2**	---	**53.4**	---	**53**	---	**70.4**	---	**42.9**	---	**50.3**	---	**50.5**	---	---	---	---	---
Salinity (ppt)	**4.5**	---	---	---	---	---	**4.5**	---	---	---	**6.3**	---	---	---	---	---	---	---	---	---	---	---
Sodium	**1230**	---	**1320**	---	**1050**	---	**1340**	---	**1270**	---	**2010**	---	**1080**	---	**1180**	---	**1230**	---	---	---	---	---
Sulfate	**149**	---	---	---	---	---	**215**	---	---	---	**187**	---	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	**4,800**	**4,650**	**5,080**	**4,680**	**3,820**	**3,590**	**4,840**	**4,080**	**4,660**	**4,440**	**6,580**	**6,220**	**4,010**	**3,990**	**4,720**	**4,080**	**4,870**	**3,820**	**1,530**	---	**2,330**	---

Notes:

B - For inorganics, result is between Reporting Limit and Method Detection Limit

JH - bias is likely high

U - not detected based on quality control criteria

Table 6R
Surface Water Screening (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field				Background					Aquatic Life Criteria - Chronic			
	Detection	Maximum	Arithmetic Mean	95% UCL	Detection	Maximum	Arithmetic Mean	std dev	Arithmetic Mean + Standard Deviation	Freshwater	Marine Water	Brackish Water	
Total Metals (Total Recoverable)													
Arsenic	2/10	0.013	0.0021	---	4/11	0.0054 B	0.0019	0.0017	0.0036	---	---	---	
Barium	10/10	1.23	0.418	0.587	11/11	0.428	0.311	0.060	0.371	---	---	---	
Cadmium	0/10	---	---	---	1/11	0.00021B	0.00016	0.00002	0.00018	---	---	---	
Chromium	10/10	0.0075 B	0.0030	0.00397	11/11	0.0046 B	0.0037	0.0006	0.0043	---	---	---	
Iron	10/10	11.3	1.99	6.507	9/9	1.76	1.02	0.41	1.43	---	---	---	
Lead	1/10	0.021	0.0034	---	7/11	0.00925	0.0058	0.0014	0.0072	---	---	---	
Magnesium	10/10	149	116	127.4	11/11	244	144.6	49.8	194.4	---	---	---	
Manganese	10/10	0.83	0.42	0.533	9/9	0.88	0.35	0.24	0.59	---	---	---	
Mercury	0/10	---	---	---	1/11	0.00007 B	0.00006	0.000005	0.00006	0.000012	0.000025	0.000012	1
Selenium	10/10	0.026	0.019	0.0213	8/11	0.0289	0.0186	0.0100	0.0286	0.005	---	0.005	2
Strontium	10/10	1.74	0.835	1.029	11/11	1.59	0.948	0.314	1.262	---	---	---	
Zinc	8/10	0.067	0.015	0.027	11/11	0.0715	0.020	0.018	0.038	---	---	---	
Total Metals (Dissolved)													
Arsenic	1/10	0.0075 B	0.0015	---	4/11	0.00845	0.0026	0.0029	0.0055	0.150	0.036	0.036	1
Barium	10/10	1.1	0.40	0.545	11/11	0.4	0.293	0.074	0.367	---	---	---	
Cadmium	0/10	---	---	---	2/11	0.00086 B	0.00028	0.00027	0.00055	0.00287	0.010	0.00287	1
Chromium	10/10	0.0051 B	0.0022	0.00283	11/11	0.0036 B	0.0026	0.0009	0.0035	0.554	0.103	0.103	1
Lead	1/10	0.0088	0.0022	---	2/11	0.0023 B	0.0016	0.0003	0.0019		0.00808	0.00808	1
Mercury	8/10	0.00012 B	0.00008	0.000094	2/11	0.00006 B	0.00006	0.000002	0.00006	0.00077	0.00094	0.00077	2
Selenium	0/10	---	---	---	2/11	0.0179	0.0059	0.0050	0.0109	---	0.071	0.071	2
Strontium	10/10	1.66	0.90	1.068	11/11	1.56	0.96	0.32	1.28	---	---	---	
Zinc	2/10	0.023	0.0062	0.0124	1/11	0.0075	0.0046	0.0013	0.0059	0.338	0.081	0.081	1
Polycyclic Aromatic Hydrocarbons													
2-Methylnaphthalene	0/10	<0.0000527	---	---	0/11	<0.0000519	---	---	---	---	---	---	
Acenaphthene	0/10	<0.0000139	---	---	1/11	0.000131	0.000024	0.000035	0.000060	---	---	---	
Acenaphthylene	0/10	<0.0000151	---	---	0/11	<0.0000149	---	---	---	---	---	---	
Anthracene	0/10	<0.00000933	---	---	0/11	<0.00000918	---	---	---	---	---	---	
Benzo(a)anthracene	0/10	<0.0000511	---	---	0/11	<0.0000503	---	---	---	---	---	---	
Benzo(a)pyrene	0/10	<0.0000139	---	---	0/11	<0.0000137	---	---	---	---	---	---	
Benzo(b)fluoranthene	0/10	<0.0000333	---	---	0/11	<0.0000328	---	---	---	---	---	---	
Benzo(k)fluoranthene	0/10	<0.0000227	---	---	0/11	<0.0000223	---	---	---	---	---	---	
Chrysene	0/10	<0.0000436	---	---	0/11	<0.000043	---	---	---	---	---	---	
Dibenz(a,h)anthracene	0/10	<0.0000198	---	---	0/11	<0.0000195	---	---	---	---	---	---	
Fluoranthene	0/10	<0.0000136	---	---	0/11	<0.0000134	---	---	---	---	---	---	
Fluorene	0/10	<0.0000187	---	---	0/11	<0.0000184	---	---	---	---	---	---	
Indeno(1,2,3-cd)pyrene	0/10	<0.0000174	---	---	0/11	<0.0000171	---	---	---	---	---	---	
Naphthalene	0/10	<0.0000287	---	---	0/11	<0.0000283	---	---	---	---	---	---	
Phenanthrene	0/10	<0.0000169	---	---	0/11	<0.0000166	---	---	---	---	---	---	
Pyrene	0/10	<0.0000183	---	---	0/11	<0.0000181	---	---	---	---	---	---	
Other Parameters													
Bicarbonate Alkalinity (mg/L CaCO3)	1/1	67.4	67.4	---	3/3	75.1	67.7	---	---	---	---	---	
Carbonate Alkalinity (mg/L CaCO3)	0/2	---	---	---	0/3	---	---	---	---	---	---	---	
Calcium	10/10	73.9	50.7	56.83	11/11	97.7	61.0	19.2	80.1	---	---	---	
Chloride	10/10	2,460	1,727	1,941	11/11	4,045	2,387	843	3,230	---	---	---	
Hardness	10/10	677	559	611	11/11	1,250	748	253	1,001	---	---	---	
Potassium	10/10	59.6	38.2	43.28	9/9	70.4	52.1	8.2	60.3	---	---	---	
Salinity (ppt)	3/3	3.7	3.1	---	3/3	6.3	5.1	---	---	---	---	---	
Sodium	10/10	1,230	878	977.7	9/9	2,010	1,301	283	1,584	---	---	---	
Sulfate	3/3	106	98.3	---	3/3	215	184	---	---	---	---	---	
Total Dissolved Solids (TDS)	10/10	4,870	3,316	3,716	11/11	6,400	4,121	1,291	5,412	---	---	---	

Notes:

UCL - upper confidence limit

Brackish criteria are the lower of freshwater and marine water, where criteria for both are available.

(1) Louisiana aquatic life criteria from Title 33, Part IX, Subpart 1, Section 1113. A hardness of 400 mg/L CaCO3 (the maximum allowed) was used to derive freshwater criteria for applicable metals. Depending on the inorganic/metal, the criteria are expressed in terms of the dissolved metal or total recoverable metal in the water column. The Louisiana criteria for mercury is based on methlymercury. Laboratory analyses for East White Lake (as presented above) are based on total (inorganic and organic) mercury. The concentration of methylmercury in surface water can be estimated by multiplying the above results by 0.0073 (0.73%) based upon a state-wide study of methylmercury fractions in Louisiana sediments (DeLaune *et al.* 2009).

(2) National Recommended Water Quality Criteria (USEPA 2009). Depending on the inorganic/metal, the criteria are expressed in terms of the dissolved metal or total recoverable metal in the water column. The national criteria for mercury was derived from data for inorganic mercury (II) but is applied as total mercury.

Results from 2010 split samples were averaged for the above statistics.

Table 12R
Wildlife HQs - Wood Duck
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wood Duck

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.024	1.45	20	0.017	0.001
Lead	0.189	3.85	19.25	0.049	0.010
Mercury	0.00083	0.013	0.064	0.064	0.013
Selenium	0.079	0.4	0.8	0.198	0.099
Zinc	12.7	55	105	0.231	0.121
SVOCs					
Total LPAHs	0.012	212	1,060	0.000	0.000
Total HPAHs	0.053	7.02	35.1	0.008	0.002

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	50	%
	$Diet_{BI}$	50	%
	$Diet_{FF}$	0	%
Ingestion-Pathway Exposures	IR_{food}	0.0443	kg/day DW
	IR_{water}	0.0445	L/day
	IR_{sed}	0.0049	kg/day DW
	AUF	100	%
	BW	0.658	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 13R
Wildlife HQs - Snowy Egret
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Snowy Egret

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.008	1.45	20	0.005	0.000
Lead	0.077	3.85	19.25	0.020	0.004
Mercury	0.00079	0.013	0.064	0.061	0.012
Selenium	0.087	0.4	0.8	0.217	0.109
Zinc	9.0	55	105	0.164	0.086
SVOCs					
Total LPAHs	0.013	212	1,060	0.000	0.000
Total HPAHs	0.013	7.02	35.1	0.002	0.000

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	0	%
	$Diet_{BI}$	35	%
	$Diet_{FF}$	65	%
Ingestion-Pathway Exposures	IR_{food}	0.0139	kg/day DW
	IR_{water}	0.0304	L/day
	IR_{sed}	0.0003	kg/day DW
	AUF	100	%
	BW	0.371	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 14R
Wildlife HQs - Belted Kingfisher
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Belted Kingfisher

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.019	1.45	20	0.013	0.001
Lead	0.217	3.85	19.25	0.056	0.011
Mercury	0.00260	0.013	0.064	0.200	0.041
Selenium	0.293	0.4	0.8	0.733	0.367
Zinc	25.1	55	105	0.457	0.239
SVOCs					
Total LPAHs	0.043	212	1,060	0.000	0.000
Total HPAHs	0.021	7.02	35.1	0.003	0.001

$$\text{Total Daily Dose} = \frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}} \qquad HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	0	%
	$Diet_{BI}$	15	%
	$Diet_{FF}$	85	%
Ingestion-Pathway Exposures	IR_{food}	0.0167	kg/day DW
	IR_{water}	0.0164	L/day
	IR_{sed}	0.0002	kg/day DW
	AUF	100	%
	BW	0.148	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 15R
Wildlife HQs - Marsh Rice Rat
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Marsh Rice Rat

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.036	1.2	12.3	0.030	0.003
Lead	0.207	20	202	0.010	0.001
Mercury	0.00129	0.036	0.059	0.036	0.022
Selenium	0.122	0.22	0.37	0.553	0.329
Zinc	19.8	213	426	0.093	0.047
SVOCs					
Total LPAHs	0.016	46	80	0.000	0.000
Total HPAHs	0.084	1.3	9.7	0.064	0.009

$$\text{Total Daily Dose} = \frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}} \qquad HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	50	%
	$Diet_{BI}$	50	%
	$Diet_{FF}$	0	%
Ingestion-Pathway Exposures	IR_{food}	0.0057	kg/day DW
	IR_{water}	0.0068	L/day
	IR_{sed}	0.0002	kg/day DW
	AUF	100	%
	BW	0.051	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 16R
Wildlife HQs - Nutria
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Nutria

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.017	0.7	7.1	0.024	0.002
Lead	0.109	15	148	0.007	0.001
Mercury	0.00046	0.026	0.043	0.018	0.011
Selenium	0.047	0.16	0.27	0.294	0.174
Zinc	3.4	99	197	0.034	0.017
SVOCs					
Total LPAHs	0.008	34	58	0.000	0.000
Total HPAHs	0.033	0.9	7.1	0.037	0.005

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	100	%
	$Diet_{BI}$	0	%
	$Diet_{FF}$	0	%
Ingestion-Pathway Exposures	IR_{food}	0.4324	kg/day DW
	IR_{water}	0.7152	L/day
	IR_{sed}	0.0432	kg/day DW
	AUF	100	%
	BW	9	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 17R
Wildlife HQs - Raccoon
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Raccoon

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.017	0.8	7.7	0.022	0.002
Lead	0.162	16	156	0.010	0.001
Mercury	0.00091	0.028	0.046	0.033	0.020
Selenium	0.091	0.17	0.29	0.534	0.313
Zinc	15.5	112	223	0.138	0.069
SVOCs					
Total LPAHs	0.013	35	61	0.000	0.000
Total HPAHs	0.039	1.0	7.5	0.039	0.005

$$\text{Total Daily Dose} = \frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}} \qquad HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	0	%
	$Diet_{BI}$	80	%
	$Diet_{FF}$	20	%
Ingestion-Pathway Exposures	IR_{food}	0.2107	kg/day DW
	IR_{water}	0.3378	L/day
	IR_{sed}	0.0198	kg/day DW
	AUF	100	%
	BW	3.91	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 18R
Wildlife HQs - Mink
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Mink

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetc Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	1.655		0.51		0.413		0.30	0.3	0.14
Lead	154.9	0.021	51.01		32.23	0.0034	1.98	3.6	3.52
Mercury	0.0554		0.0099		0.003		0.0085	0.0139	0.0245
Selenium	2.11	0.026	1.221	0.0213	1.15	0.0190	0.82	1.2	2.80
Zinc	238.2	0.067	149.6	0.027	87.4	0.015	54.8	290	209
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.015	0.9	8.9	0.017	0.002
Lead	0.165	17	169	0.010	0.001
Mercury	0.00146	0.03	0.049	0.049	0.030
Selenium	0.161	0.19	0.31	0.845	0.518
Zinc	16.8	137	274	0.123	0.061
SVOCs					
Total LPAHs	0.024	38	67	0.001	0.000
Total HPAHs	0.025	1.1	8.1	0.023	0.003

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	0	%
	$Diet_{BI}$	35	%
	$Diet_{FF}$	65	%
Ingestion-Pathway Exposures	IR_{food}	0.0687	kg/day DW
	IR_{water}	0.099	L/day
	IR_{sed}	0.0034	kg/day DW
	AUF	100	%
	BW	1	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al* . (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 19R
Summary of Wildlife HQs
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Chemical of Ecological Concern	Wood duck		Snowy egret		Belted kingfisher	
	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}
Metals						
Cadmium	0.017	0.001	0.005	0.000	0.013	0.001
Lead	0.049	0.010	0.020	0.004	0.056	0.011
Mercury	0.064	0.013	0.061	0.012	0.200	0.041
Selenium	0.198	0.099	0.217	0.109	0.733	0.367
Zinc	0.231	0.121	0.164	0.086	0.457	0.239
SVOCs						
Total LPAHs	0.000	0.000	0.000	0.000	0.000	0.000
Total HPAHs	0.008	0.002	0.002	0.000	0.003	0.001

Chemical of Ecological Concern	Marsh rice rat		Nutria		Raccoon		Mink	
	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}
Metals								
Cadmium	0.030	0.003	0.024	0.002	0.022	0.002	0.017	0.002
Lead	0.010	0.001	0.007	0.001	0.010	0.001	0.010	0.001
Mercury	0.036	0.022	0.018	0.011	0.033	0.020	0.049	0.030
Selenium	0.553	0.329	0.294	0.174	0.534	0.313	0.845	0.518
Zinc	0.093	0.047	0.034	0.017	0.138	0.069	0.123	0.061
SVOCs								
Total LPAHs	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Total HPAHs	0.064	0.009	0.037	0.005	0.039	0.005	0.023	0.003

Notes:
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
SVOC - semivolatile organic compound

Shaded values exceed an HQ of 1.0

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Arsenic	D_Arsenic
SED-1	5.65	1
SED-2	6.73	1
SED-3	8.77	1
SED-4	3.50	1
SED-5	5.47	1
SED-6	5.69	1
SED-7	3.70	1
SED-8	4.53	1
SED-9	4.75	1
SED-10	4.79	1
SED-11	5.84	1
SED-12	3.62	1
SED-13	4.23	1
SED-14	3.45	1
SED-15	4.41	1
SED-16	5.17	1
SED-17	3.87	1
SED-18	6.20	1
SED-19	3.91	1
SED-20	4.94	1
SED-21	3.54	1
SED-22	3.86	1
SED-23	5.25	1
SED-24	5.68	1
SED-25	5.04	1
SED-26	4.36	1
SED-27	4.13	1
SED-28	4.16	1
SED-29	2.77	1
SED-30	4.48	1
SED-31	4.28	1
SED-32	3.34	1
SED-33	2.91	1
SS3	8.79	1
SS5	11.40	1
SS7	22.00	1
SS8	8.01	1
SS10	7.28	1
SS11	5.28	1
SS12	6.17	1
B4	40.40	1
B5	22.60	1
B9	27.60	1
B17	40.80	1
AB13	10.68	1
AB14	5.51	1

Sample ID	Arsenic2	D_Arsenic2
SED-1	5.65	1
SED-2	6.73	1
SED-3	8.77	1
SED-4	3.50	1
SED-5	5.47	1
SED-6	5.69	1
SED-7	3.70	1
SED-8	4.53	1
SED-9	4.75	1
SED-10	4.79	1
SED-11	5.84	1
SED-12	3.62	1
SED-13	4.23	1
SED-14	3.45	1
SED-15	4.41	1
SED-16	5.17	1
SED-17	3.87	1
SED-18	6.20	1
SED-19	3.91	1
SED-20	4.94	1
SED-21	3.54	1
SED-22	3.86	1
SED-23	5.25	1
SED-24	5.68	1
SED-25	5.04	1
SED-26	4.36	1
SED-27	4.13	1
SED-28	4.16	1
SED-29	2.77	1
SED-30	4.48	1
SED-31	4.28	1
SED-32	3.34	1
SED-33	2.91	1
SS3	8.79	1
SS5	11.40	1
SS7	22.00	1
SS8	8.01	1
SS10	7.28	1
SS11	5.28	1
SS12	6.17	1
B4	10.00	1
B9	8.17	1
AB13	10.68	1
AB14	5.51	1

Sample ID	Barium	D_Barium
SED-1	404	1
SED-2	321	1
SED-3	325	1
SED-4	502	1
SED-5	169	1
SED-6	374	1
SED-7	706	1
SED-8	636	1
SED-9	519	1
SED-10	730	1
SED-11	1,136	1
SED-12	974	1
SED-13	725	1
SED-14	1,101	1
SED-15	1,445	1
SED-16	297	1
SED-17	1,725	1
SED-18	1,785	1
SED-19	2,131	1
SED-20	745	1
SED-21	532	1
SED-22	731	1
SED-23	1,061	1
SED-24	806	1
SED-25	1,260	1
SED-26	705	1
SED-27	566	1
SED-28	490	1
SED-29	599	1
SED-30	628	1
SED-31	695	1
SED-32	467	1
SED-33	533	1
SS3	1,600	1
SS5	7,450	1
SS7	15,700	1
SS8	956	1
SS10	920	1
SS11	2,750	1
SS12	2,030	1
B4	631	1
B9	368	1
B17	2,390	1
AB13	551	1
AB14	200	1

Sample ID	Cadmium	D_Cadmium
SED-1	0.268	1
SED-2	0.878	1
SED-3	0.278	0
SED-4	0.302	1
SED-5	0.258	0
SED-6	1.655	1
SED-7	0.298	1
SED-8	0.2615	0
SED-9	0.2625	0
SED-11	0.261	0
SED-13	0.2645	0
SED-15	0.50725	1
SED-19	0.14375	0
SED-24	0.2625	0
SED-26	0.2615	0
SED-28	0.359	1
SED-29	0.303	1
SED-30	0.37025	1
SED-31	0.278	0
SS8	0.354	1
SS10	0.4145	1
B4	0.77	1
B9	0.644	1
AB13	0.447	1
AB14	0.219	1

Results from 2010 split samples are incorporated in the shaded cells.

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Chromium	D_Chromium
SED-1	11.45	1
SED-2	13.97	1
SED-3	7.68	1
SED-4	10.835	1
SED-5	7.675	1
SED-6	13.835	1
SED-7	12.955	1
SED-8	12.4565	1
SED-9	13.8735	1
SED-11	14.037	1
SED-13	17.1045	1
SED-15	207.00475	1
SED-19	17.36225	1
SED-24	13.73	1
SED-26	14.383	1
SED-28	12.02	1
SED-29	15.3	1
SED-30	22.18225	1
SED-31	14.95	1
SS3	17.9	1
SS5	21.8	1
SS7	20	1
SS8	10.38	1
SS10	9.67	1
SS11	25.1	1
SS12	12.7	1
B17	62.6	1
AB13	7.73	1
AB14	12.8	1

Sample ID	Lead	D_Lead
SED-1	22.39	1
SED-2	23.61	1
SED-3	23.32	1
SED-4	17.15	1
SED-5	15.13	1
SED-6	36.97	1
SED-7	20.45	1
SED-8	20.74	1
SED-9	19.98	1
SED-11	19.04	1
SED-13	20.07	1
SED-15	87.39	1
SED-19	28.89	1
SED-24	21.58	1
SED-26	19.88	1
SED-28	18.67	1
SED-29	18.25	1
SED-30	22.78	1
SED-31	21.63	1
SS3	28.8	1
SS5	117	1
SS7	67.5	1
SS8	29.84	1
SS10	25.81	1
SS11	63.6	1
SS12	49.9	1
B4	28.7	1
B9	23.1	1
B17	64.6	1
AB13	8.11	1
AB14	14.4	1

Sample ID	Mercury	D_Mercury
SED-1	0.1145	1
SED-2	0.08	1
SED-3	0.12	1
SED-4	0.13	1
SED-5	0.3315	1
SED-6	7.59	1
SED-7	0.0995	1
SED-8	0.09725	1
SED-9	0.11075	1
SED-10	0.1435	1
SED-11	0.1205	1
SED-12	0.099	1
SED-13	0.1265	1
SED-14	0.0865	1
SED-15	0.510625	1
SED-16	0.347	1
SED-17	0.1075	1
SED-18	0.135	1
SED-19	0.1915	1
SED-20	0.1345	1
SED-21	0.07	1
SED-22	0.085	1
SED-23	0.085	1
SED-24	0.1025	1
SED-25	0.09	1
SED-26	0.31175	1
SED-27	0.09	1
SED-28	0.91	1
SED-29	0.105	1
SED-30	0.17275	1
SED-31	0.1075	1
SED-32	0.086	1
SED-33	0.09	1
SS8	1.245	1
SS10	0.213	1

Sample ID	Mercury2	D_Mercury2
SED-1	0.1145	1
SED-2	0.08	1
SED-3	0.12	1
SED-4	0.13	1
SED-5	0.3315	1
SED-6	0.88	1
SED-7	0.0995	1
SED-8	0.09725	1
SED-9	0.11075	1
SED-10	0.1435	1
SED-11	0.1205	1
SED-12	0.099	1
SED-13	0.1265	1
SED-14	0.0865	1
SED-15	0.510625	1
SED-16	0.347	1
SED-17	0.1075	1
SED-18	0.135	1
SED-19	0.1915	1
SED-20	0.1345	1
SED-21	0.07	1
SED-22	0.085	1
SED-23	0.085	1
SED-24	0.1025	1
SED-25	0.09	1
SED-26	0.31175	1
SED-27	0.09	1
SED-28	0.91	1
SED-29	0.105	1
SED-30	0.17275	1
SED-31	0.1075	1
SED-32	0.086	1
SED-33	0.09	1
SS8	1.245	1
SS10	0.213	1

95% UCL Input File for COCs in Sediment (mg/kg-DW)
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Sample ID	Selenium	D_Selenium
SED-1	1.17	0
SED-2	1.090	0
SED-3	1.740	0
SED-4	0.420	0
SED-5	0.500	0
SED-6	0.510	0
SED-7	0.800	0
SED-8	0.712	0
SED-9	0.766	0
SED-10	0.650	0
SED-11	0.921	1
SED-12	1.530	1
SED-13	1.280	1
SED-14	1.420	1
SED-15	0.996	1
SED-16	2.110	1
SED-17	1.520	1
SED-18	1.580	1
SED-19	1.028	1
SED-20	1.240	1
SED-21	1.170	1
SED-22	1.540	1
SED-23	1.610	1
SED-24	1.234	1
SED-25	1.560	1
SED-26	0.818	1
SED-27	0.970	1
SED-28	1.170	0
SED-29	1.200	0
SED-30	1.614	0
SED-31	0.830	1
SED-32	0.930	1
SED-33	1.250	0
SS8	1.140	1
SS10	1.320	1

Sample ID	Strontium	D_Strontium
SED-1	58.1	1
SED-2	57.0	1
SED-3	69.7	1
SED-4	75.4	1
SED-5	47.6	1
SED-6	110	1
SED-7	47.7	1
SED-8	46.3	1
SED-9	44.8	1
SED-11	44.6	1
SED-13	52.3	1
SED-15	98.9	1
SED-19	84.9	1
SED-24	55.2	1
SED-26	49.0	1
SED-28	265	1
SED-29	218	1
SED-30	339	1
SED-31	53.4	1
SS3	74.3	1
SS5	140	1
SS7	231	1
SS8	69.9	1
SS10	63.3	1
SS11	64.8	1
SS12	72.9	1
B4	59.3	1
B9	64.1	1
AB13	459	1
AB14	121	1

Sample ID	Zinc	D_Zinc
SED-8	50.63	1
SED-9	53.96	1
SED-11	51.58	1
SED-13	63.25	1
SED-15	60.42	1
SED-19	63.74	1
SED-24	56.14	1
SED-26	57.36	1
SED-30	238.2	1
SED-31	57.19	1
SS3	92.5	1
SS5	174	1
SS7	111	1
SS11	194	1
SS12	73.5	1
AB13	24.8	1
AB14	63.9	1

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Sample ID	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene
SED-8	0.026	0
SED-9	0.063	1
SED-11	0.029	0
SED-13	0.036	0
SED-15 (avg)	0.039	0
SED-19	0.046	0
SED-24	0.03	0
SED-26	0.032	0
SED-120 (SED-30)	0.057	0
SED-31	0.031	0

Sample ID	Chrysene	D_Chrysene
SED-8	0.028	0
SED-9	0.069	1
SED-11	0.032	0
SED-13	0.04	0
SED-15 (avg)	0.043	0
SED-19	0.051	0
SED-24	0.036	1
SED-26	0.035	0
SED-120 (SED-30)	0.063	0
SED-31	0.034	0

Sample ID	Fluorene	D_Fluorene
SED-8	0.026	0
SED-9	0.033	0
SED-11	0.029	0
SED-13	0.036	0
SED-15 (avg)	0.039	0
SED-19	0.046	0
SED-24	0.03	0
SED-26	0.032	0
SED-120 (SED-30)	0.92	1
SED-31	0.031	0

95% UCL Input File for COCs in Sediment (mg/kg-DW)
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Sample ID	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene
SED-8	0.033	0
SED-9	0.313	1
SED-11	0.038	0
SED-13	0.047	0
SED-15 (avg)	0.051	0
SED-19	0.06	0
SED-24	0.039	0
SED-26	0.041	0
SED-120 (SED-30)	0.074	0
SED-31	0.041	0

Sample ID	Phenanthrene	D_Phenanthrene
SED-8	0.033	0
SED-9	0.043	0
SED-11	0.038	0
SED-13	0.047	0
SED-15 (avg)	0.051	0
SED-19	0.06	0
SED-24	0.048	1
SED-26	0.041	0
SED-120 (SED-30)	0.074	0
SED-31	0.041	0

95% UCL Input File for COCs in Sediment (mg/kg-DW)
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Sample ID	Total LPAHs	Total HPAHs	Total PAHs
SED-8	0.233	0.37	0.603
SED-9	0.299	0.807	1.106
SED-11	0.272	0.422	0.694
SED-13	0.341	0.524	0.865
SED-15 (avg)	0.359	0.56	0.919
SED-19	0.435	0.668	1.103
SED-24	0.282	0.435	0.717
SED-26	0.299	0.46	0.759
SED-120 (SED-30)	1.401	0.826	2.227
SED-31	0.289	0.451	0.74

Sample ID	Chlorides	D_Chlorides
SED-1	5,338	1
SED-2	5,571	1
SED-3	4,930	1
SED-4	2,084	1
SED-5	1,549	1
SED-6	1,942	1
SED-7	3,983	1
SED-8	2,661	1
SED-9	2,633	1
SED-10	2,616	1
SED-11	2,875	1
SED-12	2,451	1
SED-13	4,463	1
SED-14	3,890	1
SED-15	2,721	1
SED-16	5,571	1
SED-17	2,838	1
SED-18	4,280	1
SED-19	3,633	1
SED-20	2,842	1
SED-21	2,624	1
SED-22	4,360	1
SED-23	2,576	1
SED-24	2,459	1
SED-25	3,496	1
SED-26	2,449	1
SED-27	4,251	1
SED-28	7,290	1
SED-29	9,227	1
SED-30	11,186	1
SED-31	5,086	1
SED-32	5,024	1
SED-33	11,185	1
SS1	1,950	1
SS2	1,600	1
SS3	825	1
SS4	3,850	1
SS5	1,430	1
SS6	1,700	1
SS7	2,050	1
SS9	1,500	1
SS11	540	1
SS12	610	1
SS13	1,900	1
SS14	2,250	1
SS15	1,400	1
B4	10,000	1
B5	5,800	1
B9	7,390	1
B12	7,360	1
B14	2,750	1
B17	7,950	1
B21	3,700	1
AB13	73,800	1
AB14	15,500	1

Sample ID	%Moisture	D_%Moisture (wt%)
SED-1	78.0	1
SED-2	78.9	1
SED-3	84.4	1
SED-4	51.0	1
SED-5	53.8	1
SED-6	57.9	1
SED-7	69.1	1
SED-8	64.9	1
SED-9	67.9	1
SED-10	63.6	1
SED-11	66.1	1
SED-12	68.9	1
SED-13	74.1	1
SED-14	71.3	1
SED-15	64.1	1
SED-16	80.1	1
SED-17	68.9	1
SED-18	74.3	1
SED-19	72.6	1
SED-20	68.3	1
SED-21	69.1	1
SED-22	68.6	1
SED-23	66.3	1
SED-24	64.7	1
SED-25	66.6	1
SED-26	66.5	1
SED-27	72.5	1
SED-28	77.7	1
SED-29	81.3	1
SED-30	83.0	1
SED-31	69.2	1
SED-32	72.1	1
SED-33	76.7	1
SS1	62.6	1
SS2	53.5	1
SS3	62.7	1
SS4	75.0	1
SS5	57.5	1
SS6	70.8	1
SS7	71.7	1
SS8	64.0	1
SS9	61.7	1
SS10	68.5	1
SS11	29.2	1
SS12	45.8	1
SS13	65.8	1
SS14	43.9	1
SS15	64.3	1
B4	78.4	1
B5	71.0	1
B9	74.4	1
B12	76.8	1
B14	50.2	1
B17	81.0	1
B21	76.4	1
AB13	86.0	1
AB14	62.8	1

95% UCL Input File for COCs in Sediment (mg/kg-DW)
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Sample ID	AVS/SEM [(umol/g)/(umol/g)]	D_AVS/SEM
Sed 9	18.36	1
Sed 11	27.94	1
Sed 13	81.28	1
Sed 15	74.30	1
Sed 19	95.94	1
Sed 24	47.77	1
Sed 26	19.41	1
Sed 120	1.02	1
Sed 31	6.83	1

Sample ID	TOC (%)	D_TOC (%)
SED-8	5.3	1
SED-9	3.61	1
SED-11	5.5	1
SED-13	4.59	1
SED-15	5.425	1
SED-19	4.88	1
SED-24	4.56	1
SED-26	9.45	1
SED-30	28.4	1
SED-31	5.41	1

95% UCL Output File -- Arsenic in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Arsenic Rev2.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	44	Number of Distinct Observations	44

Raw Statistics

Minimum	2.77
Maximum	22
Mean	5.825
Median	4.99
SD	3.231
Coefficient of Variation	0.555
Skewness	3.244

Log-transformed Statistics

Minimum of Log Data	1.019
Maximum of Log Data	3.091
Mean of log Data	1.667
SD of log Data	0.405

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.698
Shapiro Wilk Critical Value	0.944

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical Value	0.944

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	6.644

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	6.881
95% Modified-t UCL	6.684

Assuming Lognormal Distribution

95% H-UCL	6.438
95% Chebyshev (MVUE) UCL	7.317
97.5% Chebyshev (MVUE) UCL	7.999
99% Chebyshev (MVUE) UCL	9.34

Gamma Distribution Test

k star (bias corrected)	5.07
Theta Star	1.149
nu star	446.2
Approximate Chi Square Value (.05)	398.2
Adjusted Level of Significance	0.0445
Adjusted Chi Square Value	396.7
Anderson-Darling Test Statistic	1.525
Anderson-Darling 5% Critical Value	0.752
Kolmogorov-Smirnov Test Statistic	0.169
Kolmogorov-Smirnov 5% Critical Value	0.134

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	6.527
95% Adjusted Gamma UCL	6.552

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	6.626
95% Jackknife UCL	6.644
95% Standard Bootstrap UCL	6.61
95% Bootstrap-t UCL	7.136
95% Hall's Bootstrap UCL	9.999
95% Percentile Bootstrap UCL	6.671
95% BCA Bootstrap UCL	6.86
95% Chebyshev(Mean, Sd) UCL	7.948
97.5% Chebyshev(Mean, Sd) UCL	8.867
99% Chebyshev(Mean, Sd) UCL	10.67

Potential UCL to Use

Use 95% Student's-t UCL	6.644
or 95% Modified-t UCL	6.684

95% UCL Output File -- Barium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Barium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	45	Number of Distinct Observations	45

Raw Statistics		Log-transformed Statistics	
Minimum	169	Minimum of Log Data	5.13
Maximum	15700	Maximum of Log Data	9.661
Mean	1364	Mean of log Data	6.708
Median	706	SD of log Data	0.846
SD	2467		
Coefficient of Variation	1.809		
Skewness	5.003		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.411	Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical Value	0.945	Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1982	95% H-UCL	1547
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1879
95% Adjusted-CLT UCL	2262	97.5% Chebyshev (MVUE) UCL	2191
95% Modified-t UCL	2027	99% Chebyshev (MVUE) UCL	2802

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.058	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	1289		
nu star	95.26		
Approximate Chi Square Value (.05)	73.75	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0447	95% CLT UCL	1969
Adjusted Chi Square Value	73.12	95% Jackknife UCL	1982
		95% Standard Bootstrap UCL	1957
Anderson-Darling Test Statistic	3.222	95% Bootstrap-t UCL	3606
Anderson-Darling 5% Critical Value	0.775	95% Hall's Bootstrap UCL	4609
Kolmogorov-Smirnov Test Statistic	0.202	95% Percentile Bootstrap UCL	2024
Kolmogorov-Smirnov 5% Critical Value	0.135	95% BCA Bootstrap UCL	2452
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2967
		97.5% Chebyshev(Mean, Sd) UCL	3660
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	5023
95% Approximate Gamma UCL	1762		
95% Adjusted Gamma UCL	1777		

Potential UCL to Use			
		Use 95% Chebyshev (Mean, Sd) UCL	2967

95% UCL Output File -- Cadmium in Sediment (mg/kg-DW)
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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Cadmium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Data	25	Number of Detected Data	15
Number of Distinct Detected Data	15	Number of Non-Detect Data	10
		Percent Non-Detects	40.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.219	Minimum Detected	-1.519
Maximum Detected	1.655	Maximum Detected	0.504
Mean of Detected	0.519	Mean of Detected	-0.812
SD of Detected	0.367	SD of Detected	0.534
Minimum Non-Detect	0.144	Minimum Non-Detect	-1.94
Maximum Non-Detect	0.278	Maximum Non-Detect	-1.28

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	13
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	48.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.716	Shapiro Wilk Test Statistic	0.912
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.362	Mean	-1.32
SD	0.342	SD	0.764
95% DL/2 (t) UCL	0.479	95% H-Stat (DL/2) UCL	0.468
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.237	Mean in Log Scale	-1.298
SD	0.473	SD in Log Scale	0.744
95% MLE (t) UCL	0.399	Mean in Original Scale	0.365
95% MLE (Tiku) UCL	0.433	SD in Original Scale	0.34
		95% Percentile Bootstrap UCL	0.483
		95% BCA Bootstrap UCL	0.521

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	2.717	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
Theta Star	0.191		
nu star	81.51		
A-D Test Statistic	0.815	**Nonparametric Statistics**	
5% A-D Critical Value	0.743	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.743	Mean	0.4

95% UCL Output File -- Cadmium in Sediment (mg/kg-DW)
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5% K-S Critical Value	0.223

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.123
Maximum	1.655
Mean	0.458
Median	0.392
SD	0.305
k star	3.157
Theta star	0.145
Nu star	157.9
AppChi2	129.8
95% Gamma Approximate UCL	0.557
95% Adjusted Gamma UCL	0.564

Note: DL/2 is not a recommended method.

SD	0.311
SE of Mean	0.0645
95% KM (t) UCL	0.51
95% KM (z) UCL	0.506
95% KM (jackknife) UCL	0.498
95% KM (bootstrap t) UCL	0.599
95% KM (BCA) UCL	0.553
95% KM (Percentile Bootstrap) UCL	0.526
95% KM (Chebyshev) UCL	0.68
97.5% KM (Chebyshev) UCL	0.802
99% KM (Chebyshev) UCL	1.041

Potential UCLs to Use

95% KM (t) UCL	0.51

95% UCL Output File -- Chloride in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Chlorides.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	55	Number of Distinct Observations	54

Raw Statistics		Log-transformed Statistics	
Minimum	540	Minimum of Log Data	6.292
Maximum	73800	Maximum of Log Data	11.21
Mean	5381	Mean of log Data	8.146
Median	2875	SD of log Data	0.813
SD	9857		
Coefficient of Variation	1.832		
Skewness	6.435		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.312	Lilliefors Test Statistic	0.0978
Lilliefors Critical Value	0.119	Lilliefors Critical Value	0.119
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	7605	95% H-UCL	6065
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	7325
95% Adjusted-CLT UCL	8799	97.5% Chebyshev (MVUE) UCL	8434
95% Modified-t UCL	7797	99% Chebyshev (MVUE) UCL	10612

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.208	**Data appear Lognormal at 5% Significance Level**	
Theta Star	4453		
nu star	132.9		
Approximate Chi Square Value (.05)	107.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0456	95% CLT UCL	7567
Adjusted Chi Square Value	106.7	95% Jackknife UCL	7605
		95% Standard Bootstrap UCL	7518
Anderson-Darling Test Statistic	2.612	95% Bootstrap-t UCL	11842
Anderson-Darling 5% Critical Value	0.773	95% Hall's Bootstrap UCL	15855
Kolmogorov-Smirnov Test Statistic	0.169	95% Percentile Bootstrap UCL	7843
Kolmogorov-Smirnov 5% Critical Value	0.123	95% BCA Bootstrap UCL	9385
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11174
		97.5% Chebyshev(Mean, Sd) UCL	13681
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	18605
95% Approximate Gamma UCL	6666		
95% Adjusted Gamma UCL	6705		

Potential UCL to Use			
		Use 95% H-UCL	6065

95% UCL Output File – Chromium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Chromium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	29	Number of Distinct Observations	29

Raw Statistics		Log-transformed Statistics	
Minimum	7.675	Minimum of Log Data	2.038
Maximum	207	Maximum of Log Data	5.333
Mean	22.53	Mean of log Data	2.756
Median	13.87	SD of log Data	0.644
SD	36.84		
Coefficient of Variation	1.635		
Skewness	4.844		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.347	Shapiro Wilk Test Statistic	0.732
Shapiro Wilk Critical Value	0.926	Shapiro Wilk Critical Value	0.926
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	34.17	95% H-UCL	24.87
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	29.89
95% Adjusted-CLT UCL	40.36	97.5% Chebyshev (MVUE) UCL	34.52
95% Modified-t UCL	35.2	99% Chebyshev (MVUE) UCL	43.61

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.401	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	16.09		
nu star	81.25		
Approximate Chi Square Value (.05)	61.48	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0407	95% CLT UCL	33.79
Adjusted Chi Square Value	60.45	95% Jackknife UCL	34.17
		95% Standard Bootstrap UCL	33.79
Anderson-Darling Test Statistic	4.279	95% Bootstrap-t UCL	99.2
Anderson-Darling 5% Critical Value	0.762	95% Hall's Bootstrap UCL	84.86
Kolmogorov-Smirnov Test Statistic	0.297	95% Percentile Bootstrap UCL	35.88
Kolmogorov-Smirnov 5% Critical Value	0.165	95% BCA Bootstrap UCL	43.71
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	52.35
		97.5% Chebyshev(Mean, Sd) UCL	65.26
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	90.6
95% Approximate Gamma UCL	29.78		
95% Adjusted Gamma UCL	30.29		

Potential UCL to Use			
		Use 95% Chebyshev (Mean, Sd) UCL	52.35

95% UCL Output File – Lead in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Lead.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	31	Number of Distinct Observations	31

Raw Statistics		Log-transformed Statistics	
Minimum	8.11	Minimum of Log Data	2.093
Maximum	117	Maximum of Log Data	4.762
Mean	32.23	Mean of log Data	3.289
Median	22.78	SD of log Data	0.572
SD	23.99		
Coefficient of Variation	0.744		
Skewness	2.168		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.709	Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	39.55	95% H-UCL	38.87
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	46.26
95% Adjusted-CLT UCL	41.11	97.5% Chebyshev (MVUE) UCL	52.69
95% Modified-t UCL	39.83	99% Chebyshev (MVUE) UCL	65.31

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.623	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	12.29		
nu star	162.6		
Approximate Chi Square Value (.05)	134.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0413	95% CLT UCL	39.32
Adjusted Chi Square Value	132.7	95% Jackknife UCL	39.55
		95% Standard Bootstrap UCL	39.21
Anderson-Darling Test Statistic	2.256	95% Bootstrap-t UCL	42.67
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	42.65
Kolmogorov-Smirnov Test Statistic	0.246	95% Percentile Bootstrap UCL	39.41
Kolmogorov-Smirnov 5% Critical Value	0.159	95% BCA Bootstrap UCL	41.86
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	51.01
		97.5% Chebyshev(Mean, Sd) UCL	59.14
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	75.1
95% Approximate Gamma UCL	39.08		
95% Adjusted Gamma UCL	39.5		

Potential UCL to Use	
Use 95% Chebyshev (Mean, Sd) UCL	51.01

95% UCL Output File -- Mercury in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Mercury.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	35	Number of Distinct Observations	31

Raw Statistics

Minimum	0.07
Maximum	7.59
Mean	0.413
Median	0.115
SD	1.272
Coefficient of Variation	3.083
Skewness	5.603

Log-transformed Statistics

Minimum of Log Data	-2.659
Maximum of Log Data	2.027
Mean of log Data	-1.819
SD of log Data	0.953

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.272
Shapiro Wilk Critical Value	0.934

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.709
Shapiro Wilk Critical Value	0.934

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.776

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.984
95% Modified-t UCL	0.81

Assuming Lognormal Distribution

95% H-UCL	0.374
95% Chebyshev (MVUE) UCL	0.453
97.5% Chebyshev (MVUE) UCL	0.54
99% Chebyshev (MVUE) UCL	0.712

Gamma Distribution Test

k star (bias corrected)	0.617
Theta Star	0.669
nu star	43.18
Approximate Chi Square Value (.05)	29.12
Adjusted Level of Significance	0.0425
Adjusted Chi Square Value	28.57
Anderson-Darling Test Statistic	6.329
Anderson-Darling 5% Critical Value	0.797
Kolmogorov-Smirnov Test Statistic	0.328
Kolmogorov-Smirnov 5% Critical Value	0.156

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.612
95% Adjusted Gamma UCL	0.624

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.766
95% Jackknife UCL	0.776
95% Standard Bootstrap UCL	0.766
95% Bootstrap-t UCL	2.498
95% Hall's Bootstrap UCL	2.028
95% Percentile Bootstrap UCL	0.834
95% BCA Bootstrap UCL	1.115
95% Chebyshev(Mean, Sd) UCL	1.35
97.5% Chebyshev(Mean, Sd) UCL	1.755
99% Chebyshev(Mean, Sd) UCL	2.552

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 1.35

95% UCL Output File -- Mercury in Sediment Excluding SD-06 (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Mercury Rev2.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	35	Number of Distinct Observations	31

Raw Statistics		Log-transformed Statistics	
Minimum	0.07	Minimum of Log Data	-2.659
Maximum	1.245	Maximum of Log Data	0.219
Mean	0.221	Mean of log Data	-1.88
Median	0.115	SD of log Data	0.744
SD	0.267		
Coefficient of Variation	1.21		
Skewness	2.735		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.563	Shapiro Wilk Test Statistic	0.784
Shapiro Wilk Critical Value	0.934	Shapiro Wilk Critical Value	0.934
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.297	95% H-UCL	0.264
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.319
95% Adjusted-CLT UCL	0.317	97.5% Chebyshev (MVUE) UCL	0.37
95% Modified-t UCL	0.301	99% Chebyshev (MVUE) UCL	0.472

Gamma Distribution Test		Data Distribution
k star (bias corrected)	1.388	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.159	
nu star	97.15	
Approximate Chi Square Value (.05)	75.41	**Nonparametric Statistics**
Adjusted Level of Significance	0.0425	95% CLT UCL 0.295
Adjusted Chi Square Value	74.51	95% Jackknife UCL 0.297
		95% Standard Bootstrap UCL 0.294
Anderson-Darling Test Statistic	4.12	95% Bootstrap-t UCL 0.355
Anderson-Darling 5% Critical Value	0.767	95% Hall's Bootstrap UCL 0.305
Kolmogorov-Smirnov Test Statistic	0.297	95% Percentile Bootstrap UCL 0.301
Kolmogorov-Smirnov 5% Critical Value	0.151	95% BCA Bootstrap UCL 0.323
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.418
		97.5% Chebyshev(Mean, Sd) UCL 0.503
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.67
95% Approximate Gamma UCL	0.284	
95% Adjusted Gamma UCL	0.288	

Potential UCL to Use	
Use 95% Chebyshev (Mean, Sd) UCL	0.418

95% UCL Output File -- Selenium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Selenium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Data	35	Number of Detected Data	21
Number of Distinct Detected Data	21	Number of Non-Detect Data	14
		Percent Non-Detects	40.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.818	Minimum Detected	-0.201
Maximum Detected	2.11	Maximum Detected	0.747
Mean of Detected	1.274	Mean of Detected	0.211
SD of Detected	0.325	SD of Detected	0.253
Minimum Non-Detect	0.42	Minimum Non-Detect	-0.868
Maximum Non-Detect	1.74	Maximum Non-Detect	0.554

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	34
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	97.14%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.94	Shapiro Wilk Test Statistic	0.961
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.958	Mean	-0.198
SD	0.482	SD	0.61
95% DL/2 (t) UCL	1.096	95% H-Stat (DL/2) UCL	1.241
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.0333
		SD in Log Scale	0.308
		Mean in Original Scale	1.084
		SD in Original Scale	0.351
		95% Percentile Bootstrap UCL	1.178
		95% BCA Bootstrap UCL	1.189
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	14.25	**Data appear Normal at 5% Significance Level**	
Theta Star	0.0894		
nu star	598.4		
A-D Test Statistic	0.352	**Nonparametric Statistics**	
5% A-D Critical Value	0.743	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.743	Mean	1.118

95% UCL Output File – Selenium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
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Vermilion Parish, Louisiana

5% K-S Critical Value	0.189

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.818
Maximum	2.11
Mean	1.228
Median	1.234
SD	0.289
k star	18.03
Theta star	0.0681
Nu star	1262
AppChi2	1180
95% Gamma Approximate UCL	1.312
95% Adjusted Gamma UCL	1.317

Note: DL/2 is not a recommended method.

SD	0.326
SE of Mean	0.0583
95% KM (t) UCL	1.217
95% KM (z) UCL	1.214
95% KM (jackknife) UCL	1.214
95% KM (bootstrap t) UCL	1.223
95% KM (BCA) UCL	1.235
95% KM (Percentile Bootstrap) UCL	1.221
95% KM (Chebyshev) UCL	1.373
97.5% KM (Chebyshev) UCL	1.483
99% KM (Chebyshev) UCL	1.699

Potential UCLs to Use

95% KM (t) UCL	1.217
95% KM (Percentile Bootstrap) UCL	1.221

95% UCL Output File – Strontium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Strontium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	30	Number of Distinct Observations	30

Raw Statistics

Minimum	44.6
Maximum	459
Mean	107.9
Median	67.25
SD	98.49
Coefficient of Variation	0.913
Skewness	2.321

Log-transformed Statistics

Minimum of Log Data	3.798
Maximum of Log Data	6.129
Mean of log Data	4.43
SD of log Data	0.644

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.656
Shapiro Wilk Critical Value	0.927

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.829
Shapiro Wilk Critical Value	0.927

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	138.4

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	145.6
95% Modified-t UCL	139.7

Assuming Lognormal Distribution

95% H-UCL	132
95% Chebyshev (MVUE) UCL	158.6
97.5% Chebyshev (MVUE) UCL	182.9
99% Chebyshev (MVUE) UCL	230.6

Gamma Distribution Test

k star (bias corrected)	1.955
Theta Star	55.19
nu star	117.3
Approximate Chi Square Value (.05)	93.28
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	92.05
Anderson-Darling Test Statistic	2.663
Anderson-Darling 5% Critical Value	0.758
Kolmogorov-Smirnov Test Statistic	0.269
Kolmogorov-Smirnov 5% Critical Value	0.162

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	135.6
95% Adjusted Gamma UCL	137.5

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	137.5
95% Jackknife UCL	138.4
95% Standard Bootstrap UCL	137.4
95% Bootstrap-t UCL	158
95% Hall's Bootstrap UCL	148.7
95% Percentile Bootstrap UCL	138.4
95% BCA Bootstrap UCL	147.7
95% Chebyshev(Mean, Sd) UCL	186.3
97.5% Chebyshev(Mean, Sd) UCL	220.2
99% Chebyshev(Mean, Sd) UCL	286.8

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 186.3

95% UCL Output File -- Total Organic Carbon in Sediment (%)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - TOC.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics

Minimum	3.61
Maximum	28.4
Mean	7.713
Median	5.355
SD	7.43
Coefficient of Variation	0.963
Skewness	2.932

Log-transformed Statistics

Minimum of Log Data	1.284
Maximum of Log Data	3.346
Mean of log Data	1.825
SD of log Data	0.587

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.522
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.702
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	12.02

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	13.9
95% Modified-t UCL	12.38

Assuming Lognormal Distribution

95% H-UCL	11.68
95% Chebyshev (MVUE) UCL	13.22
97.5% Chebyshev (MVUE) UCL	15.82
99% Chebyshev (MVUE) UCL	20.91

Gamma Distribution Test

k star (bias corrected)	1.784
Theta Star	4.323
nu star	35.68
Approximate Chi Square Value (.05)	23.01
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	21.26
Anderson-Darling Test Statistic	1.693
Anderson-Darling 5% Critical Value	0.734
Kolmogorov-Smirnov Test Statistic	0.411
Kolmogorov-Smirnov 5% Critical Value	0.269

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	11.96
95% Adjusted Gamma UCL	12.94

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	11.58
95% Jackknife UCL	12.02
95% Standard Bootstrap UCL	11.31
95% Bootstrap-t UCL	41.98
95% Hall's Bootstrap UCL	42.14
95% Percentile Bootstrap UCL	12.14
95% BCA Bootstrap UCL	14.67
95% Chebyshev(Mean, Sd) UCL	17.95
97.5% Chebyshev(Mean, Sd) UCL	22.38
99% Chebyshev(Mean, Sd) UCL	31.09

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 17.95

95% UCL Output File -- Moisture Content in Sediment (%)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\Sediment - Moisture.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	57	Number of Distinct Observations	55

Raw Statistics

Minimum	29.2
Maximum	86
Mean	67.83
Median	68.9
SD	10.57
Coefficient of Variation	0.156
Skewness	-1.131

Log-transformed Statistics

Minimum of Log Data	3.374
Maximum of Log Data	4.454
Mean of log Data	4.203
SD of log Data	0.182

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.135
Lilliefors Critical Value	0.117

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.183
Lilliefors Critical Value	0.117

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	70.18

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	69.91
95% Modified-t UCL	70.14

Assuming Lognormal Distribution

95% H-UCL	70.85
95% Chebyshev (MVUE) UCL	75.13
97.5% Chebyshev (MVUE) UCL	78.23
99% Chebyshev (MVUE) UCL	84.33

Gamma Distribution Test

k star (bias corrected)	32.93
Theta Star	2.06
nu star	3754
Approximate Chi Square Value (.05)	3612
Adjusted Level of Significance	0.0458
Adjusted Chi Square Value	3609
Anderson-Darling Test Statistic	1.639
Anderson-Darling 5% Critical Value	0.748
Kolmogorov-Smirnov Test Statistic	0.165
Kolmogorov-Smirnov 5% Critical Value	0.118

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	70.49
95% Adjusted Gamma UCL	70.56

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	70.14
95% Jackknife UCL	70.18
95% Standard Bootstrap UCL	70.14
95% Bootstrap-t UCL	70.05
95% Hall's Bootstrap UCL	69.98
95% Percentile Bootstrap UCL	70.07
95% BCA Bootstrap UCL	69.94
95% Chebyshev(Mean, Sd) UCL	73.94
97.5% Chebyshev(Mean, Sd) UCL	76.58
99% Chebyshev(Mean, Sd) UCL	81.77

Potential UCL to Use

Use 95% Student's-t UCL	70.18
or 95% Modified-t UCL	70.14

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Metals (Total Recoverable)															
Sample ID	Arsenic-T	D_Arsenic-T	Barium-T	D_Barium-T	Calcium-T	D_Calcium-T	Chromium-T	D_Chromium-T	Iron-T	D_Iron-T	Lead-T	D_Lead-T	Magnesium-T	D_Magnesium-T	Manganese-T	D_Manganese-T
SW-01	0.00079	0	0.282	1	38.4	1	0.0026	1	1.26	1	0.0015	0	88.2	1	0.23	1
SW-02	0.00079	0	0.288	1	44.1	1	0.0023	1	0.8	1	0.0015	0	100	1	0.27	1
SW-03	0.00079	0	0.281	1	43.3	1	0.0026	1	1.08	1	0.0015	0	98.3	1	0.3	1
SW-04	0.00079	0	0.258	1	44.6	1	0.0022	1	0.49	1	0.0015	0	103	1	0.16	1
SW-05	0.0019	1	0.278	1	43.1	1	0.0025	1	0.85	1	0.0015	0	99.1	1	0.31	1
SW-06	0.00079	0	0.368	1	54.3	1	0.0025	1	0.94	1	0.0015	0	127	1	0.46	1
SW-07	0.00079	0	0.432	1	56.1	1	0.0025	1	0.94	1	0.0015	0	130	1	0.61	1
SW-09	0.00079	0	0.397	1	59	1	0.0027	1	1.115	1	0.0015	0	140.5	1	0.505	1
SW-10	0.00079	0	0.363	1	50.6	1	0.0022	1	1.09	1	0.0015	0	120	1	0.48	1
SW-20	0.013	1	1.23	1	73.9	1	0.0075	1	11.3	1	0.021	1	149	1	0.83	1

Results from 2010 split samples are incorporated in the shaded cells.

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Metals (Total Recoverable)									
Sample ID	Potassium-T	D_Potassium-T	Sodium-T	D_Sodium-T	Selenium-T	D_Selenium-T	Strontium-T	D_Strontium-T	Zinc-T	D_Zinc-T
SW-01	29.2	1	631	1	0.0193	1	0.597	1	0.0116	1
SW-02	33.3	1	727	1	0.0188	1	0.674	1	0.0087	1
SW-03	32.7	1	771	1	0.0213	1	0.629	1	0.0095	1
SW-04	34.4	1	808	1	0.0183	1	0.667	1	0.008	1
SW-05	33.1	1	769	1	0.0203	1	0.661	1	0.008	1
SW-06	38.6	1	935	1	0.0258	1	0.815	1	0.01	1
SW-07	40.7	1	981	1	0.0178	1	0.864	1	0.007	0
SW-09	42.75	1	1007.5	1	0.0198	1	0.915	1	0.007	0
SW-10	37.2	1	917	1	0.0213	1	0.791	1	0.012	1
SW-20	59.6	1	1230	1	0.0037	0	1.74	1	0.067	1

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Metals (Dissolved)													
Sample ID	Arsenic-D	D_Arsenic-D	Barium-D	D_Barium-D	Chromium-D	D_Chromium-D	Lead-D	D_Lead-D	Mercury-D	D_Mercury-D	Strontium-D	D_Strontium-D	Zinc-D	D_Zinc-D
SW-01	0.00079	0	0.28	1	0.0017	1	0.0015	0	0.000055	0	0.69	1	0.004	0
SW-02	0.00079	0	0.28	1	0.0016	1	0.0015	0	0.00009	1	0.74	1	0.004	0
SW-03	0.00079	0	0.29	1	0.0018	1	0.0015	0	0.00009	1	0.71	1	0.004	0
SW-04	0.00079	0	0.26	1	0.0017	1	0.0015	0	0.00006	1	0.73	1	0.004	0
SW-05	0.00079	0	0.26	1	0.0018	1	0.0015	0	0.00007	1	0.69	1	0.004	0
SW-06	0.00079	0	0.37	1	0.0021	1	0.0015	0	0.0001	1	0.91	1	0.004	0
SW-07	0.00079	0	0.42	1	0.002	1	0.0015	0	0.00009	1	0.93	1	0.004	0
SW-09	0.00079	0	0.375	1	0.0023	1	0.0015	0	0.00008	1	1.015	1	0.00675	1
SW-10	0.00079	0	0.35	1	0.0022	1	0.0015	0	0.00012	1	0.88	1	0.004	0
SW-20	0.0075	1	1.1	1	0.0051	1	0.0088	1	0.000055	0	1.66	1	0.023	1

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Total PAHs			Other Parameters									
Sample ID	Total LPAHs	Total HPAHs	Total PAHs	Calcium	D_Calcium	Hardness	D_Hardness	Magnesium	D_Magnesium	Chloride	D_Chloride	TDS	D_TDS
SW-01	0.000153	0.000230	0.000383	38.4	1	437	1	88.2	1	1370	1	2645	1
SW-02	0.000155	0.000234	0.000389	44.1	1	505	1	100	1	1445	1	2820	1
SW-03	0.000155	0.000234	0.000389	43.3	1	463	1	98.3	1	1370	1	2725	1
SW-04	0.000155	0.000232	0.000387	44.6	1	500	1	103	1	1475	1	3005	1
SW-05	0.000151	0.000228	0.000379	43.1	1	485	1	99.1	1	1460	1	2770	1
SW-06	0.000154	0.000231	0.000385	54.3	1	597	1	127	1	1765	1	3715	1
SW-07	0.000153	0.000230	0.000383	56.1	1	623	1	130	1	1885	1	3425	1
SW-09	0.000153	0.000230	0.000383	59	1	670	1	140.5	1	2133	1	3818	1
SW-10	0.000153	0.000230	0.000383	50.6	1	633	1	120	1	1905	1	3370	1
SW-20	0.000151	0.000228	0.000379	73.9	1	677	1	149	1	2460	1	4870	1

95% UCL Output File -- Arsenic (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\East White Lake Stats Combined SW Data Rev2.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0019	Minimum Detected	-6.266
Maximum Detected	0.013	Maximum Detected	-4.343
Mean of Detected	0.00745	Mean of Detected	-5.304
SD of Detected	0.00785	SD of Detected	1.36
Minimum Non-Detect	0.00079	Minimum Non-Detect	-7.143
Maximum Non-Detect	0.00079	Maximum Non-Detect	-7.143

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00181	Mean	-7.33
SD	0.00396	SD	1.16
95% DL/2 (t) UCL	0.0041	95% H-Stat (DL/2) UCL	0.00404
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	0.358	**Nonparametric Statistics**	

95% UCL Output File -- Arsenic (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.00301
5% K-S Critical Value	N/A	SD	0.00333
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00149
		95% KM (t) UCL	0.00574
Assuming Gamma Distribution		95% KM (z) UCL	0.00546
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	N/A
Minimum	N/A	95% KM (bootstrap t) UCL	N/A
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	0.0095
SD	N/A	97.5% KM (Chebyshev) UCL	0.0123
k star	N/A	99% KM (Chebyshev) UCL	0.0178
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (BCA) UCL	N/A
95% Gamma Approximate UCL	N/A		
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

95% UCL Output File -- Barium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\95UCL_Input_SW_MPA_ICON May2010_MDL_ALL_O
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.258	Minimum of Log Data	-1.355
Maximum	1.23	Maximum of Log Data	0.207
Mean	0.418	Mean of log Data	-0.998
Median	0.326	SD of log Data	0.459
SD	0.292		
Coefficient of Variation	0.698		
Skewness	2.924		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.547	Shapiro Wilk Test Statistic	0.706
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.587	95% H-UCL	0.57
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.665
95% Adjusted-CLT UCL	0.66	97.5% Chebyshev (MVUE) UCL	0.777
95% Modified-t UCL	0.601	99% Chebyshev (MVUE) UCL	0.998
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.969	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	0.141		
nu star	59.38		
Approximate Chi Square Value (.05)	42.66	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	0.569
Adjusted Chi Square Value	40.21	95% Jackknife UCL	0.587
		95% Standard Bootstrap UCL	0.564
Anderson-Darling Test Statistic	1.46	95% Bootstrap-t UCL	1.018
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	1.162
Kolmogorov-Smirnov Test Statistic	0.308	95% Percentile Bootstrap UCL	0.593
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL	0.685
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.82
		97.5% Chebyshev(Mean, Sd) UCL	0.993
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.335
95% Approximate Gamma UCL	0.581		
95% Adjusted Gamma UCL	0.617		
Potential UCL to Use		Use 95% Student's-t UCL	0.587
		or 95% Modified-t UCL	0.601

95% UCL Output File -- Chromium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\East White Lake Stats Combined SW Data Rev2.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	6
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.0022	Minimum of Log Data	-6.119
Maximum	0.0075	Maximum of Log Data	-4.893
Mean	0.00296	Mean of log Data	-5.9
Median	0.0025	SD of log Data	0.361
SD	0.0016		
Coefficient of Variation	0.542		
Skewness	3.095		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.465	Shapiro Wilk Test Statistic	0.549
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.00389	95% H-UCL	0.00374
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.00436
95% Adjusted-CLT UCL	0.00432	97.5% Chebyshev (MVUE) UCL	0.00499
95% Modified-t UCL	0.00397	99% Chebyshev (MVUE) UCL	0.00623
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.702	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	0.00062951		
nu star	94.04		
Approximate Chi Square Value (.05)	72.68	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	0.00379
Adjusted Chi Square Value	69.42	95% Jackknife UCL	0.00389
		95% Standard Bootstrap UCL	0.00372
Anderson-Darling Test Statistic	2.226	95% Bootstrap-t UCL	0.00874
Anderson-Darling 5% Critical Value	0.728	95% Hall's Bootstrap UCL	0.00895
Kolmogorov-Smirnov Test Statistic	0.441	95% Percentile Bootstrap UCL	0.00396
Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	0.00447
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.00517
		97.5% Chebyshev(Mean, Sd) UCL	0.00613
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.00801
95% Approximate Gamma UCL	0.00383		
95% Adjusted Gamma UCL	0.00401		

Potential UCL to Use		
	Use 95% Student's-t UCL	0.00389
	or 95% Modified-t UCL	0.00397

95% UCL Output File -- Lead (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\My Documents\Clients\East White Lake\East White Lake Stats Combined SW Data Rev2.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Lead-T was not processed!

95% UCL Output File -- Selenium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\brenda_basile\My Documents\Clients\East White Lake\East White Lake Statistics Comb
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Data	10	Number of Detected Data	9
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
		Percent Non-Detects	10.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0178	Minimum Detected	-4.029
Maximum Detected	0.0258	Maximum Detected	-3.657
Mean of Detected	0.0203	Mean of Detected	-3.903
SD of Detected	0.0024	SD of Detected	0.111
Minimum Non-Detect	0.0037	Minimum Non-Detect	-5.599
Maximum Non-Detect	0.0037	Maximum Non-Detect	-5.599

Warning: There are only 9 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.855	Shapiro Wilk Test Statistic	0.893
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0185	Mean	-4.142
SD	0.00626	SD	0.763
95% DL/2 (t) UCL	0.0221	95% H-Stat (DL/2) UCL	0.0274
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0184	Mean in Log Scale	-3.929
SD	0.00599	SD in Log Scale	0.134
95% MLE (t) UCL	0.0219	Mean in Original Scale	0.0198
95% MLE (Tiku) UCL	0.0221	SD in Original Scale	0.00272
		95% Percentile Bootstrap UCL	0.0213
		95% BCA Bootstrap UCL	0.0214

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	58.51	**Data appear Normal at 5% Significance Level**
Theta Star	0.0003469	

nu star	1053		
A-D Test Statistic	0.444	**Nonparametric Statistics**	
5% A-D Critical Value	0.72	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.72	Mean	0.0201
5% K-S Critical Value	0.279	SD	0.00227
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0007621
		95% KM (t) UCL	0.0214
Assuming Gamma Distribution		95% KM (z) UCL	0.0213
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0214
Minimum	0.0164	95% KM (bootstrap t) UCL	0.0221
Maximum	0.0258	95% KM (BCA) UCL	0.0214
Mean	0.0199	95% KM (Percentile Bootstrap) UCL	0.0215
Median	0.0196	95% KM (Chebyshev) UCL	0.0234
SD	0.00258	97.5% KM (Chebyshev) UCL	0.0248
k star	49.33	99% KM (Chebyshev) UCL	0.0276
Theta star	0.0004035		
Nu star	986.7	**Potential UCLs to Use**	
AppChi2	914.8	95% KM (t) UCL	0.0214
95% Gamma Approximate UCL	0.0215	95% KM (Percentile Bootstrap) UCL	0.0215
95% Adjusted Gamma UCL	0.0218		

Note: DL/2 is not a recommended method.

95% UCL Output File -- Strontium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\95UCL_Input_SW_MPA_ICON May2010_MDL_ALL_O
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.597	Minimum of Log Data	-0.516
Maximum	1.74	Maximum of Log Data	0.554
Mean	0.835	Mean of log Data	-0.231
Median	0.733	SD of log Data	0.311
SD	0.335		
Coefficient of Variation	0.401		
Skewness	2.594		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.658	Shapiro Wilk Test Statistic	0.783
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.03	95% H-UCL	1.023
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.186
95% Adjusted-CLT UCL	1.103	97.5% Chebyshev (MVUE) UCL	1.341
95% Modified-t UCL	1.044	99% Chebyshev (MVUE) UCL	1.645
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.998	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
Theta Star	0.119		
nu star	140		
Approximate Chi Square Value (.05)	113.6	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	1.01
Adjusted Chi Square Value	109.5	95% Jackknife UCL	1.03
		95% Standard Bootstrap UCL	0.997
Anderson-Darling Test Statistic	1.011	95% Bootstrap-t UCL	1.315
Anderson-Darling 5% Critical Value	0.725	95% Hall's Bootstrap UCL	1.679
Kolmogorov-Smirnov Test Statistic	0.246	95% Percentile Bootstrap UCL	1.026
Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	1.073
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.298
		97.5% Chebyshev(Mean, Sd) UCL	1.498
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.89
95% Approximate Gamma UCL	1.029		
95% Adjusted Gamma UCL	1.068		
Potential UCL to Use		Use 95% Approximate Gamma UCL	1.029

95% UCL Output File -- Zinc (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\brenda_basile\My Documents\Clients\East White Lake\East White Lake Statistics Comb
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Data	10	Number of Detected Data	8
Number of Distinct Detected Data	7	Number of Non-Detect Data	2
		Percent Non-Detects	20.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.008	Minimum Detected	-4.828
Maximum Detected	0.067	Maximum Detected	-2.703
Mean of Detected	0.0169	Mean of Detected	-4.406
SD of Detected	0.0203	SD of Detected	0.705
Minimum Non-Detect	0.007	Minimum Non-Detect	-4.962
Maximum Non-Detect	0.007	Maximum Non-Detect	-4.962

Warning: There are only 8 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.487	Shapiro Wilk Test Statistic	0.619
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0142	Mean	-4.656
SD	0.0188	SD	0.815
95% DL/2 (t) UCL	0.0251	95% H-Stat (DL/2) UCL	0.0232
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.012	Mean in Log Scale	-4.69
SD	0.0202	SD in Log Scale	0.867
95% MLE (t) UCL	0.0237	Mean in Original Scale	0.0141
95% MLE (Tiku) UCL	0.0234	SD in Original Scale	0.0188
		95% Percentile Bootstrap UCL	0.0254
		95% BCA Bootstrap UCL	0.0312

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.145	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.0147	
nu star	18.32	

95% UCL Output File -- Zinc (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

A-D Test Statistic	1.715	**Nonparametric Statistics**	
5% A-D Critical Value	0.727	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.727	Mean	0.0151
5% K-S Critical Value	0.298	SD	0.0174
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00587
		95% KM (t) UCL	0.0258
Assuming Gamma Distribution		95% KM (z) UCL	0.0247
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0257
Minimum	1E-09	95% KM (bootstrap t) UCL	0.108
Maximum	0.067	95% KM (BCA) UCL	0.027
Mean	0.0137	95% KM (Percentile Bootstrap) UCL	0.0265
Median	0.0091	95% KM (Chebyshev) UCL	0.0407
SD	0.0191	97.5% KM (Chebyshev) UCL	0.0517
k star	0.314	99% KM (Chebyshev) UCL	0.0735
Theta star	0.0438		
Nu star	6.276	**Potential UCLs to Use**	
AppChi2	1.782	95% KM (BCA) UCL	0.027
95% Gamma Approximate UCL	0.0484		
95% Adjusted Gamma UCL	0.0617		

Note: DL/2 is not a recommended method.

95% UCL Output File -- Chlorides in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\95UCL_Input_SW_MPA_ICON May2010_MDL_ALL_O
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	10	Number of Distinct Observations	9
Raw Statistics		**Log-transformed Statistics**	
Minimum	1370	Minimum of Log Data	7.223
Maximum	2460	Maximum of Log Data	7.808
Mean	1727	Mean of log Data	7.435
Median	1620	SD of log Data	0.204
SD	369.6		
Coefficient of Variation	0.214		
Skewness	0.888		

Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.878	Shapiro Wilk Test Statistic	0.893
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1941	95% H-UCL	1966
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2213
95% Adjusted-CLT UCL	1954	97.5% Chebyshev (MVUE) UCL	2425
95% Modified-t UCL	1947	99% Chebyshev (MVUE) UCL	2839
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	18.26	**Data appear Normal at 5% Significance Level**	
Theta Star	94.57		
nu star	365.2		
Approximate Chi Square Value (.05)	321.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	1919
Adjusted Chi Square Value	314.8	95% Jackknife UCL	1941
		95% Standard Bootstrap UCL	1913
Anderson-Darling Test Statistic	0.529	95% Bootstrap-t UCL	1994
Anderson-Darling 5% Critical Value	0.725	95% Hall's Bootstrap UCL	1977
Kolmogorov-Smirnov Test Statistic	0.263	95% Percentile Bootstrap UCL	1917
Kolmogorov-Smirnov 5% Critical Value	0.266	95% BCA Bootstrap UCL	1933
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2236
		97.5% Chebyshev(Mean, Sd) UCL	2457
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2890
95% Approximate Gamma UCL	1959		
95% Adjusted Gamma UCL	2003		
Potential UCL to Use		Use 95% Student's-t UCL	1941

95% UCL Output File -- Hardness in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\95UCL_Input_SW_MPA_ICON May2010_MDL_ALL_O
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	437	Minimum of Log Data	6.08
Maximum	677	Maximum of Log Data	6.518
Mean	559	Mean of log Data	6.314
Median	551	SD of log Data	0.163
SD	90.21		
Coefficient of Variation	0.161		
Skewness	0.05		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.897	Shapiro Wilk Test Statistic	0.9
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	611.3	95% H-UCL	618.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	684.8
95% Adjusted-CLT UCL	606.4	97.5% Chebyshev (MVUE) UCL	739.2
95% Modified-t UCL	611.4	99% Chebyshev (MVUE) UCL	846.1

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	29.68	**Data appear Normal at 5% Significance Level**	
Theta Star	18.83		
nu star	593.7		
Approximate Chi Square Value (.05)	538.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	605.9
Adjusted Chi Square Value	529	95% Jackknife UCL	611.3
		95% Standard Bootstrap UCL	603.6
Anderson-Darling Test Statistic	0.521	95% Bootstrap-t UCL	610.8
Anderson-Darling 5% Critical Value	0.724	95% Hall's Bootstrap UCL	598.3
Kolmogorov-Smirnov Test Statistic	0.225	95% Percentile Bootstrap UCL	604.4
Kolmogorov-Smirnov 5% Critical Value	0.266	95% BCA Bootstrap UCL	602.6
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	683.3
		97.5% Chebyshev(Mean, Sd) UCL	737.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	842.8
95% Approximate Gamma UCL	616.7		
95% Adjusted Gamma UCL	627.4		

Potential UCL to Use		
	Use 95% Student's-t UCL	611.3

95% UCL Output File -- Total Dissolved Solids (TDS) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\My Documents\Clients\East White Lake\95UCL_Input_SW_MPA_ICON May2010_MDL_ALL_O
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	2645	Minimum of Log Data	7.88
Maximum	4870	Maximum of Log Data	8.491
Mean	3316	Mean of log Data	8.089
Median	3188	SD of log Data	0.193
SD	689.7		
Coefficient of Variation	0.208		
Skewness	1.319		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.868	Shapiro Wilk Test Statistic	0.907
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3716	95% H-UCL	3747
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4200
95% Adjusted-CLT UCL	3772	97.5% Chebyshev (MVUE) UCL	4583
95% Modified-t UCL	3731	99% Chebyshev (MVUE) UCL	5336

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	20.04	**Data appear Normal at 5% Significance Level**	
Theta Star	165.5		
nu star	400.7		
Approximate Chi Square Value (.05)	355.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	3675
Adjusted Chi Square Value	347.9	95% Jackknife UCL	3716
		95% Standard Bootstrap UCL	3653
Anderson-Darling Test Statistic	0.439	95% Bootstrap-t UCL	3900
Anderson-Darling 5% Critical Value	0.725	95% Hall's Bootstrap UCL	3938
Kolmogorov-Smirnov Test Statistic	0.182	95% Percentile Bootstrap UCL	3672
Kolmogorov-Smirnov 5% Critical Value	0.266	95% BCA Bootstrap UCL	3766
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4267
		97.5% Chebyshev(Mean, Sd) UCL	4678
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	5486
95% Approximate Gamma UCL	3740		
95% Adjusted Gamma UCL	3820		

Potential UCL to Use		
	Use 95% Student's-t UCL	3716

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A Site-Specific Evaluation of Mercury Toxicity in Sediment

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Abstract. A site-specific evaluation of mercury toxicity was conducted for sediments of the Calcasieu River estuary (Louisiana, USA). Ten-day whole-sediment toxicity tests assessed survival and growth (dry weight) of the amphipods *Hyalella azteca* and *Leptocheirus plumulosus* under estuarine conditions (10 ppt salinity). A total of 32 sediment samples were tested for toxicity, including 14 undiluted site sediment samples and 6 sediment dilution series. All sediment samples were analyzed for total mercury and numerous other chemical parameters, including acid volatile sulfide (AVS) and simultaneously extracted metals (SEM). No toxicity attributable to mercury was observed, indicating that a site-specific threshold for total mercury toxicity to amphipods exceeds 4.1 mg/kg dry weight. Site-specific factors that may limit mercury bioavailability and toxicity include relatively high sulfide levels. Additionally, the chemical extractability of mercury in site sediments is low, as indicated by SEM mercury analyses for three sediment samples containing a range of total mercury concentrations.

The Calcasieu River in southwestern Louisiana, USA, is an economically important tributary to the Gulf of Mexico. Portions of the Calcasieu River estuary are highly industrialized, particularly in the vicinity of the tributary Bayou d'Inde, and the estuary has historically been impacted by industrial and municipal discharges, navigation channel maintenance, agricultural and urban storm runoff, and local oil and gas fields. Mercury is present at elevated concentrations in the sediments of Bayou d'Inde (Mueller *et al.* 1989) and has been identified as one of several chemicals of concern in the Calcasieu River estuary (Pereira *et al.* 1988; Cunningham *et al.* 1990; Redmond *et al.* 1996). This paper presents the results of site-specific sediment toxicity studies designed to determine a safe concentration for mercury exposure to benthic invertebrates.

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Studies conducted by Cunningham *et al.* (1990) and reported by Redmond *et al.* (1996) identified toxicity to *Ampelisca abdita* following exposure to sediments collected from the Calcasieu River estuary, including Bayou d'Inde; these authors concluded that mercury or other measured or unmeasured chemicals could have contributed to the observed toxicity. Gaston and Young (1992) reported an inverse relationship between various heavy metals, including mercury, and the numbers of benthic organisms in the Bayou d'Inde estuary. None of these studies demonstrated a causal relationship between mercury concentrations and observed effects.

Though the toxicity of all chemicals in sediment is affected by site-specific conditions, the factors that interact to affect the toxicity of mercury are especially numerous. Important factors influencing the bioavailability and chemical form of mercury in sediments include concentrations of organic carbon, sulfide, sulfate, nutrients, group VI anions, pH, salinity, and temperature (Gilmour and Henry 1991; Beckvar *et al.* 1996). The industrialized portion of the Calcasieu River estuary is characterized by relatively slow flow through marshy areas, and thus the sediment of Bayou d'Inde in particular consists of fine-grain depositional material that is high in total organic carbon (TOC), with typical TOC levels of 5–6%. Sulfide levels in these sediments are also relatively high. Both of these characteristics can generally be expected to reduce the bioavailability and toxicity of mercury in sediment (Breteler *et al.* 1981; Langston 1982, 1985, 1986; Gilmour and Capone 1987; Persaud *et al.* 1987; Parks *et al.* 1989; Winfrey and Rudd 1990).

Two sediment toxicity studies were conducted in Bayou d'Inde and surrounding areas of the estuary to evaluate the relationship between mercury concentrations and toxicological responses of the amphipods *Hyalella azteca* and *Leptocheirus plumulosus.* First, a dilution study was conducted to develop site-specific no-effect concentrations for a variety of chemicals, including mercury. As described by Fuchsman *et al.* (1999), the dilution study revealed a strong concentration-response relationship for hexachlorobutadiene, which could potentially have obscured effects due to mercury in some samples. Therefore, a follow-up study was conducted focusing specifically on mercury toxicity. Considered together, the two studies provide a basis for a site-specific evaluation of mercury toxicity to amphipods.

Materials and Methods

Dilution Study

Surface sediment samples were collected at three locations in Bayou d'Inde and seven locations in an industrial discharge canal, as described by Fuchsman *et al.* (1999). One 20-L sediment sample was collected from each location, and a 50-L sample for use as a sediment diluent was also collected from Bayou d'Inde. Depending on sample location conditions, sediment samples were collected using a standard ponar dredge, a petite ponar, or the extended arm of a trackhoe. Following sediment processing (sieving to remove large debris, homogenization) and the collection of subsamples for physical and chemical analysis, the headspace in each sediment sample container for toxicity testing was filled with laboratory-supplied estuarine water (5 ppt salinity), approximately equaling one part water to two parts sediment. The addition of water was intended to reduce ammonia concentrations and allow equilibration of salinity levels; however, the effectiveness of this procedure in reducing ammonia levels is unclear and was not tested as part of this study.

Following laboratory confirmation that the diluent sediment was not toxic, sediment dilution ratios were designed to provide a range of chemical concentrations and test organism responses. As the dilution study was intended to investigate the toxicity of multiple chemicals, the dilution ratios were based on a holistic review of each sample's chemical composition, rather than on mercury concentrations alone. In fact, the mercury concentration in the diluent was greater than in three of the samples that were diluted. A total of six dilution series were prepared for toxicity testing, each series consisting of four samples (one undiluted and three diluted sediment samples). The four remaining undiluted sediment samples and a duplicate 100% diluent sample were also tested for toxicity. All sediment samples (including undiluted samples) were thoroughly mixed using a rolling mill, and sediments were then dispensed to the toxicity test chambers and allowed to settle for 24 h.

Prior to the initiation of the toxicity tests, physical and chemical analyses were performed on subsamples of each prepared dilution series sample. Additionally, potential losses of mercury and other chemicals prior to toxicity testing were evaluated by reanalyzing three of the undiluted sediment samples. Total mercury concentrations were measured using atomic absorption spectroscopy (method 7040; US EPA 1986); other analyses are detailed by Fuchsman *et al.* (1999). Following the completion of toxicity tests, analyses of acid volatile sulfide (AVS) and simultaneously extracted metals (SEM) (Allen *et al.* 1991), and water quality parameters in porewater were conducted using sediment subsamples that had been treated as toxicity test replicates. No organisms were added to these ''chemistry'' replicates in the dilution study, and SEM mercury was not analyzed.

Standard 10-day toxicity tests measured survival and growth (dry weight) of *L. plumulosus* (ASTM 1996) and *H. azteca* (ASTM 1995). The tests were initiated with juvenile *L. plumulosus* (2–4 mm) and *H. azteca* (2–3 mm) obtained from commercial suppliers. Test chambers were held at 20 ± 2°C, and continuous light was used to induce burrowing of the *H. azteca* test organisms. Preliminary tests of the sediment diluent at 5 ppt and 10 ppt salinity indicated higher *L. plumulosus* survival and acceptable *H. azteca* survival at 10 ppt (TR Barber, unpublished data); subsequent toxicity tests were conducted with overlying water at 10 ppt, which is also approximately equal to the average salinity of bottom waters in the vicinity of lower Bayou d'Inde. Overlying water was renewed three times during the tests, and test organisms were fed 7 mg rabbit chow five times during the course of the test.

Significant toxicity of the test samples was defined based on comparisons to laboratory control samples (*L. plumulosus* native sediment from St. Augustine, FL). Statistical comparisons used one-way analysis of variance (ANOVA) and Dunnett's test (parametric) or Kruskal-Wallis one-way ANOVA on ranks and Dunn's method (nonparametric). Parametric tests were used unless the assumptions of normality (Kolmogorov-Smirnov test) and equality of variances (Levene's method) were not satisfied following arcsine square root transformation. Samples were considered toxic if a given test end point (survival or weight) was both statistically different from the laboratory control sample ($p < 0.05$) and at least 20% lower than mean test organism response in the control sample (Thursby *et al.* 1997).

Follow-up Study

A follow-up study was conducted to evaluate the toxicity of three Bayou d'Inde sediment samples containing a range of mercury concentrations and relatively low concentrations of other co-contaminants. Sediment collection, toxicity testing, and analytical chemistry procedures were similar to those employed in the dilution study. Mercury concentrations in each sample were evaluated three times, including an expedited field analysis, an analysis conducted prior to toxicity testing, and an analysis conducted following completion of toxicity tests. No trend of increasing or decreasing concentrations was observed, and the average concentration was considered representative of the total mercury concentration to which toxicity test organisms were exposed.

Three differences between dilution study and follow-up study methods are noteworthy. Due to concerns about potential loss of chemical contaminants, estuarine water was not added to sediment sample containers in the follow-up study, although the possibility of elevated ammonia concentrations was recognized. Ammonia concentrations in overlying water were monitored during toxicity testing. Additionally, amphipods were placed in the sediment replicates used for post-toxicity test analyses. The addition of organisms was intended to provide analytical results that most closely approximated toxicity test exposure conditions by incorporating any effects of bioturbation on AVS levels. Finally, in the follow-up study, SEM mercury was included in the post-toxicity chemical analyses. Though mercury is not among the metals for which the comparison of SEM and AVS concentrations has been demonstrated to provide a consistent no-effect threshold for sediment toxicity (Ankley *et al.* 1996), the difference between total mercury concentrations and the concentrations of mercury extractable using the less aggressive SEM extraction procedure may provide some insight into the site-specific bioavailability of mercury.

Results

Dilution Study

Mercury was detected in 28 of 29 dilution study sediment samples, with concentrations ranging from 0.5 to 4.3 mg/kg. These and subsequent chemical concentrations are reported on a dry-weight basis unless stated otherwise. Mercury concentrations measured in three of the undiluted sediment samples immediately prior to toxicity testing were 0%, 35%, and 60% lower than the corresponding concentrations measured prior to the addition of water to the samples in the field. However, mercury is considered highly persistent in sediment, and further evaluation suggests no systematic loss of mercury from the sediment samples. Measured mercury concentrations in the diluted sediment samples were compared to concentrations predicted from measurements of the undiluted samples, the diluent, and the appropriate ratio between the two. This evaluation included three dilution series for which the undiluted ''parent'' samples had not been reanalyzed for mercury immediately prior to toxicity testing; a loss of mercury due to

sediment-handling procedures would have resulted in overprediction of mercury concentrations in the associated diluted sediment samples. In fact, measured and predicted values were within 25% of each other for all but two sediment samples (data not shown). One measured mercury concentration was identified as an outlier, because it was twice as high as the predicted concentration. To conserve space, analytical results for chemicals other than mercury in the dilution study are not shown here but are available on request.

The toxicity tests for the dilution study were considered acceptable, based on control survival exceeding 90% for both test species. Overlying water quality conditions were acceptable for temperature (18.0–20.9°C, averaging approximately 19°C), pH (6.8–8.8, averaging 7.9), dissolved oxygen (36–117% of saturation, averaging approximately 90% of saturation), and salinity (9.0–11.2 ppt, averaging 10.0 ppt). Porewater salinity levels were very similar to levels measured in overlying water (9.6–11.0 ppt, averaging 10.4 ppt). Porewater ammonia concentrations ranged from 0.55 to 4.15 mg/L, averaging 1.7 mg/L.

Toxicity test results showed a range of test organism responses (Table 1), which appeared to be explained primarily by concentrations of hexachlorobutadiene rather than mercury. In fact, logistic curve-fitting analysis explained approximately 90% of the variation in survival of both test species based on hexachlorobutadiene concentrations (Fuchsman *et al.* 1999). By comparison, Spearman rank correlation analysis indicated no significant negative correlation between mercury concentrations and test organism survival or dry weight (Figure 1). However, a preliminary evaluation of site-specific mercury toxicity was possible based on mercury concentrations in nontoxic sediment samples.

A total of six sediment samples in the dilution study were not toxic to either test species. The maximum mercury concentration among these samples was 2.8 mg/kg. Toxicity associated with mercury concentrations greater than 2.8 mg/kg was either marginal (survival or weight measured at 70–80% of control) or was clearly attributable to hexachlorobutadiene (sample 06 and its dilutions; Fuchsman *et al.* 1999). Mercury concentrations associated with marginal toxicity ranged from undetectable ($<$0.2 mg/kg) to 3.5 mg/kg (excluding the concentration of 4.3 mg/kg identified as an outlier). Thus, the dilution study provided a lower limit of 2.8 mg/kg for the estimate of a site-specific sediment effects threshold for mercury.

Follow-up Study

Average mercury concentrations in the follow-up study sediment samples were 0.3, 3.6, and 4.1 mg/kg (sample codes HG-001, HG-007, and HG-010, respectively). Interestingly, sample HG-007 was initially measured as containing a mercury concentration of 10.7 mg/kg. Triplicate reanalyses of sediment from each of the first two HG-007 subsamples analyzed for mercury failed to confirm this initial measurement, although the sediment had been homogenized prior to subsampling. It is not possible to determine whether these results indicate analytical variability or sample heterogeneity. SEM mercury concentrations were much lower than total mercury concentrations, ranging from undetectable ($<$0.06 mg/kg; samples HG-001, HG-010) to 0.06 mg/kg (sample HG-007). Concentrations of AVS in the follow-up study ranged from 10 to 770 mg/kg. Depletion of AVS associated with bioturbation was not evident, as AVS levels were generally higher than in the dilution study, in which amphipods were not added to chemistry replicates.

Toxicity test results for the follow-up study include two rounds of testing (Table 2). It was necessary to repeat the toxicity tests because amphipod survival in the laboratory control sediment was below ASTM-specified acceptability criteria for both species, and both species showed anomalously low survival in individual replicate test chambers (0–10% survival as compared to 75–100% survival in other replicates of the same sediment sample). This replicate-specific mortality occurred in both the control and test samples and was not explained by measured water quality conditions (*e.g.*, ammonia, dissolved oxygen; Table 3). However, results are reported for the first round of toxicity testing (Test 1) because *L. plumulosus* survival was notably higher than in the second round of testing (Test 2), whereas the difficulties identified in Test 1 would be expected to have produced the opposite effect. Post-toxicity test analyses of AVS, SEM, and porewater chemistry were conducted only for Test 2.

H. azteca survival and growth appeared to be unaffected by mercury concentrations. Although *H. azteca* weight decreased slightly with increasing mercury concentrations in Test 1, and organism weights for the two highest test concentrations were significantly different from the laboratory control, *H. azteca* weight showed no toxicity during Test 2. Survival of *L. plumulosus* in Test 1 showed no evidence of toxicity (Table 2). However, without exhibiting a concentrations-response relationship with mercury, all three test samples were associated with poor *L. plumulosus* survival in Test 2. This result does not appear to be explained by measured chemical concentrations, as sample HG-001 exhibited the highest mortality and contained the lowest concentrations of most detected chemicals (Table 4). Water quality data collected during the course of Test 2 also do not explain the observed results, although a single replicate test chamber of sample HG-007 exhibited 0% survival after developing cloudy overlying water and an ammonia concentration of 8.7 mg/L. By comparison, the next highest ammonia concentration noted in Test 2 (6.2 mg/L) occurred in the control sample and did not appear to affect the test organisms (survival of 95%). Test organism variability may be one contributing factor, as the *L. plumulosus* test organisms used for the follow-up study were smaller than those used during the dilution study (though within ASTM protocol guidelines), and it is possible that the organisms were responding to some physical attribute of the test sediments. For example, increasing clay content has been shown to adversely affect *L. plumulosus* survival in 28-day toxicity tests (Emery *et al.* 1997), although the species is generally considered to be tolerant of a variety of sediment types (ASTM 1996). Regardless, the observed toxicity did not appear to be associated with mercury at the concentrations tested. Thus, no toxicity attributable to total mercury was observed for either species or endpoint at a maximum mercury concentration of 4.1 mg/kg.

Discussion

Published sediment quality guidelines for mercury range from 0.13 mg/kg (MacDonald 1994) to 2 mg/kg (Jaagumagi 1993). These guidelines are based on compilations of data associating mercury concentrations with various measures of toxicity and are relatively unsuccessful at predicting sediment toxicity, even within the data sets from which they are derived. For example,

Table 1. Summary of dilution study mercury concentrations and associated toxicity test results

Sample[a]	Mercury (mg/kg)	Total Organic Carbon (%)	AVS (mg/kg)	*H. azteca* Survival (% of Control)	*H. azteca* Mean Weight (% of Control)	*L. plumulosus* Survival (% of Control)	*L. plumulosus* Mean Weight (% of Control)
Diluent-100%	2.3	3.39	19.8	89	93	97	76
01–100%	2.5 J	3.93	37.4	79	87	86	84
02–100%	3.0 J	3.99	13.4	81	70*	80*	93
03–100%	3.5 J	3.08	17.8	80*	101	99	101
08–100%	0.1 U	0.277	0.01	79*	87	92	91
04–100%	0.5 J	7.41	3.4	59*	55*	59*	67
04–90%	1.26 J	5.05	31.2	72	76*	80*	80
04–20%	2.4 J	5.61	29.0	74	81	77*	63
04–10%	2.4 J	4.41	34.3	85	70*	84	86
05–100%	1.8 J	2.32	0.1	50*	40*	37*	57
05–60%	1.8 J	2.22	5.0	84	54*	77*	74
05–40%	2.1 J	2.86	13.7	81	74*	90	96
05–20%	4.3 J[b]	3.81	21.2	88	87	74*	162
06–100%	4.3 J	5.24	2.7	0*	NC	0*	NC
06–20%	3.3 J	5.18	2.5	1*	NC	9*	62
06–10%	2.8 J	5.08	31.2	27*	54*	62*	107
06–5%	3.1 J	4.52	40.5	38*	49*	82	101
07–100%	1.9 J	1.23	2.8	0*	NC	0*	NC
07–20%	2.2 J	3.24	34.3	1*	NC	0*	NC
07–10%	2.3 J	3.71	34.3	0*	NC	0*	NC
07-5%	2.3 J	3.97	7.5	0*	NC	2*	NC
09–100%	0.5 J	1.95	10.3	0*	NC	0*	NC
09–50%	1.2 J	4.11	27.4	0*	NC	0*	NC
09–20%	2.1 J	3.89	34.3	0*	NC	39*	66
09–10%	2.5 J	3.69	24.6	0*	NC	94	96
10–100%	2.8 J	3.20	12.8	92	91	104	104
10–60%	2.2 J	3.01	24.3	88	102	92	107
10–40%	2.4 J	3.11	18.7	87	103	104	111
10–20%	2.6 J	3.13	15.0	88	92	95	91

[a] Sample codes indicate the percentage of ''parent'' sediment for diluted sediment samples. For example, sample 04–90% contained 90% sediment from sample 04 and 10% diluent sediment

[b] Mercury concentration identified as an outlier based on comparison of measured and predicted concentrations

* Indicates statistical and at least 20% difference from control samples

J Laboratory qualifier: estimated concentration

U Not detected; concentration represents one-half the sample detection limit

NC Not calculated; survival exhibited severe toxicity

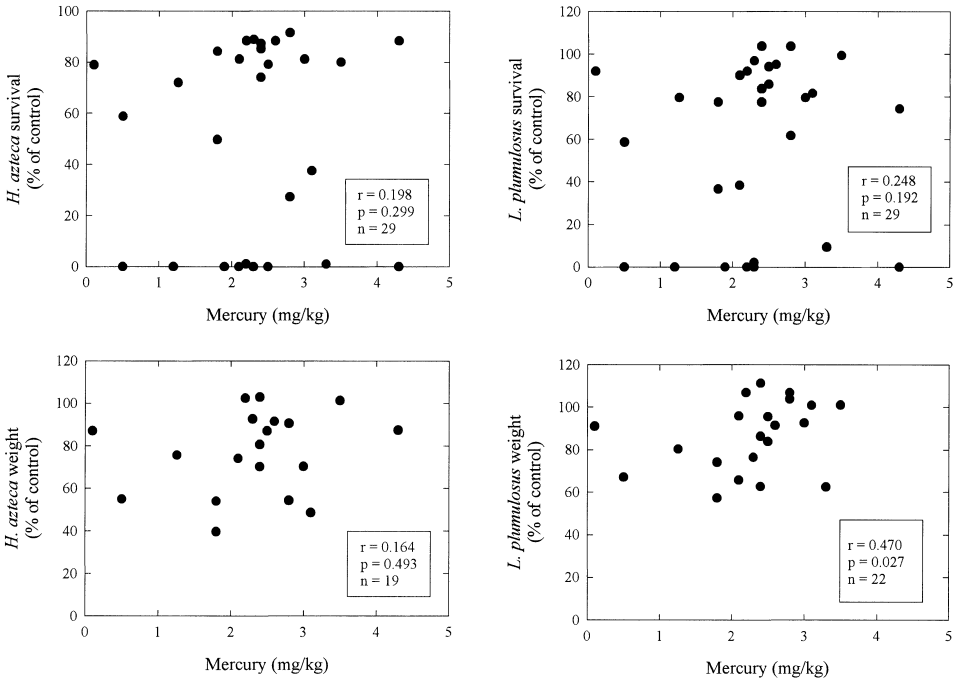

Fig. 1. Mercury concentrations versus amphipod survival and weight in the sediment dilution study. Results of Spearman rank correlation analyses are provided and show no significant negative association between mercury concentrations and amphipod responses

Table 2. Summary of follow-up study mercury concentrations and toxicity test results

Sample Code	Mercury Concentration (Mean ± SD [# samples] [mg/kg])	*L. plumulosus*		*H. azteca*	
		Survival (%)	Mean Weight (mg/organism)	Survival (%)	Mean Weight (mg/organism)
Test 1					
—	Control	88	0.42	75	0.20
HG-001	0.27 ± 0.17 (3)	83	0.24*	88	0.16
HG-007	3.6[a] ± 2.5 (9)	73	0.30	91	0.15*
HG-010	4.1 ± 0.39 (3)	76	0.32	77	0.14*
Test 2					
—	Control	95	0.18	91	0.30
HG-001	0.27 ± 0.17 (3)	34*	0.11*	89	0.25
HG-007	3.6[a] ± 2.5 (9)	63*	0.17	87	0.25
HG-010	4.1 ± 0.39 (3)	37*	0.14	90	0.24

[a] Original field sample analysis excluded as an outlier

* At least 20% different and statistically different from the control sample ($p < 0.05$)

Table 3. Summary of overlying water quality in follow-up study toxicity tests[a]

Sample	pH	Dissolved Oxygen (% Sat.)	Temperature (°C)	Salinity (ppt)	Ammonia (mg/L)
Leptocheirus plumulosus Test 1					
Control	7.8 (7.1–8.2)	86 (53–100)	20.3 (19.7–20.7)	10.5 (10.2–10.9)	0.109 (0.055–0.172)
HG-001	7.6 (6.9–8.0)	85 (23–100)	20.3 (19.1–20.7)	10.5 (10.1–10.8)	0.528 (0.285–0.739)
HG-007	7.8 (7.5–8.2)	85 (56–97)	20.2 (19.7–20.6)	10.5 (9.9–10.8)	1.442 (0.336–2.470)
HG-010	7.8 (7.3–8.0)	87 (68–98)	20.2 (19.7–20.6)	10.5 (10.1–10.7)	1.464 (0.596–2.010)
Leptocheirus plumulosus Test 2					
Control	7.9 (7.7–8.1)	92 (73–100)	20.2 (19.6–20.6)	10.4 (10.2–10.7)	2.283 (0.550–6.180)
HG-001	7.7 (6.9–8.0)	90 (50–102)	20.2 (19.7–20.7)	10.4 (10.2–10.5)	0.670 (0.356–0.940)
HG-007	7.9 (7.7–8.1)	93 (79–101)	20.0 (19.5–20.7)	10.4 (10.2–10.5)	2.623 (0.652–8.660)
HG-010	7.8 (7.4–8.0)	90 (72–100)	20.0 (19.4–20.8)	10.3 (10.2–10.5)	1.219 (0.558–1.800)
Hyalella azteca Test 1					
Control	7.9 (7.2–8.2)	84 (9–99)	20.1 (19.2–20.6)	10.5 (10.0–10.8)	0.031 (0.029–0.032)
HG-001	7.7 (7.4–7.9)	89 (76–99)	20.1 (19.5–20.6)	10.4 (10.0–10.7)	0.485 (0.108–0.790)
HG-007	7.8 (7.3–8.1)	86 (65–105)	20.0 (19.2–20.4)	10.4 (10.0–10.7)	1.855 (0.639–2.990)
HG-010	7.8 (7.1–8.1)	83 (42–98)	20.1 (19.2–20.5)	10.4 (10.1–10.6)	1.669 (0.276–2.470)
Hyalella azteca Test 2					
Control	8.0 (7.5–8.1)	95 (84–99)	20.3 (19.9–20.7)	10.4 (10.1–10.5)	0.282 (0.144–0.398)
HG-001	7.8 (7.6–8.0)	96 (87–103)	20.2 (19.7–20.9)	10.3 (10.2–10.4)	0.175 (0.035–0.356)
HG-007	8.0 (7.7–8.3)	94 (84–100)	20.2 (19.9–20.6)	10.4 (10.2–10.5)	0.256 (0.074–0.966)
HG-010	7.9 (7.7–8.2)	95 (88–99)	20.3 (19.9–20.7)	10.3 (10.1–10.4)	0.259 (0.094–0.700)

[a] Average (minimum–maximum)

within the data set of Long *et al.* (1995), toxicity was observed in less than half of the studies reporting mercury concentrations that exceeded the effects-range median benchmark. The biological effects database for sediment compiled by MacDonald (1994) includes studies in which mercury concentrations as high as 254 mg/kg in sediment (Salazar *et al.* 1980) did not produce a biological effect. The relatively poor predictive ability of the available sediment quality guidelines for mercury may reflect the site-specific nature of mercury toxicity, or it may reflect in part the uncertainty of association-based data collected at sites contaminated with multiple potentially toxic chemicals.

Several studies at mercury-contaminated sites have provided results that are consistent with this study's findings of a lack of toxicity to benthic invertebrates at mercury concentrations that exceed available sediment quality guidelines. In a study noteworthy for its long exposure duration, Rubinstein *et al.* (1983) found that survival of polychaete worms (*Nereis viriens*), clams (*Mercenaria mercenaria*), and grass shrimp (*Palaemonetes pugio*) was unaffected following 100 days of exposure to New York Harbor sediment containing 35 mg/kg mercury. The authors hypothesized that high organic content of the test sediment (up to 22%) could account for the lack of bioavailability. The sediment also contained a considerable amount of sulfur, and formation of mercuric sulfide (cinnabar) could also have accounted for the low availability of mercury (Rubinstein *et al.* 1983). Similarly, sediment samples from Brunswick Estuary, GA (USA), containing 17.8 mg/kg and 24.7 mg/kg mercury caused no mortality in 10-day whole-sediment tests with *H. azteca;* these sediment samples also contained relatively high levels of organic carbon and sulfide (Winger *et al.* 1993). More recently, a dilution study with sediment from Brunswick Estuary indicated significant mortality to *L. plumulosus* following 28-day exposures to mercury concentrations exceeding 550 mg/kg, but no significant toxicity at mercury

Table 4. Physical and chemical concentrations detected in follow-up study sediment samples

Sample Code	HG-001	HG-007	HG-010
Physical parameters (%)			
Total organic carbon	3.2	3.8	3.6
Solids	48	36	34
Sand	8.3	36	32
Silt	49	31	34
Clay	43	32	34
Inorganic chemicals (mg/kg)			
Aluminum	7,271	7,778	8,088
Ammonia (porewater, mg/L)	1.48	2.34	1.12
Barium	108	517	638
Chromium	13	36	41
Cobalt	1.7 U	6.9 B	5.3 B
Copper	13	103	124
Iron	4,833	11,167	11,029
Lead	21	53	68
Manganese	59 J	117	103 J
Nickel	4.8 U	39	44
Selenium	0.86 U	2.0 B	1.7 B
Vanadium	17 B	15 B	15 B
Zinc	25 J	183	191
AVS and SEM (mmol/kg)			
AVS	0.31	24	14
Cadmium	0.002 U	0.002 U	0.002 U
Copper	0.05	0.57	0.44
Lead	0.05	0.25	0.25
Mercury	0.0001 U	0.0003	0.0001 U
Nickel	0.04 U	0.24	0.19
Zinc	0.18	2.7	2.5
SEM − AVS	0.01	−20.28	−10.95
Organic chemicals (mg/kg normalized to 1% TOC)			
Chlorobenzene	0.002 U	0.08	0.002 U
1,3-Dichlorobenzene	0.07 J	0.01 NJ	0.33
1,4-Dichlorobenzene	0.04 J	0.01 NJ	0.24 J
1,2,4-Trichlorobenzene	0.11 U	0.08 J	0.06 J
Hexachlorobenzene	0.37	5.8 D	2.0
DDT, 4,4′-	0.02 J	0.16 J	0.08 J
Hexachlorobutadiene	0.11 U	0.19 J	0.12 J
Total Petroleum Hydrocarbons	49 J	563 J	515 J
Polycyclic aromatic hydrocarbons (mg/kg normalized to 1% TOC)			
Phenanthrene	0.11 U	0.07 J	0.07 J
Benzo(a)anthracene	0.11 UJ	0.05 J	0.05 J
Benzo(a)pyrene	0.11 U	0.05 J	0.08 J
Benzo(b)fluoranthene	0.11 U	0.05 J	0.04 J
Benzo(g,h,i)perylene	0.11 U	0.05 J	0.05 J
Benzo(k)fluoranthene	0.11 U	0.03 J	0.03 J
Chrysene	0.11 UJ	0.12 J	0.11 J
Fluoranthene	0.11 U	0.07 J	0.07 J
Pyrene	0.11 UJ	0.17 J	0.13 J

D Reported from a dilution
B Inorganics: reported concentration below quantitative detection limit
J Estimated value
N Presumptively present
U Not detected; concentration represents one-half the sample detection limit

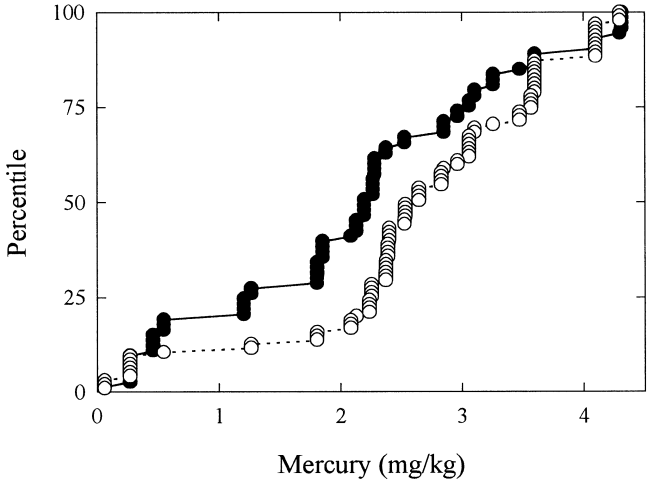

Fig. 2. Cumulative frequencies of mercury concentrations measured in toxic (●) and nontoxic (○) sediment samples. Results are included for each of four toxicity test endpoints in the dilution and follow-up studies

concentrations of 390 mg/kg or less (PTI 1998). Recent studies in Lavaca Bay, TX (USA), showed no evidence of mercury-related effects on benthic macroinvertebrate community structure (MacLellan *et al.* 1997) and no toxicity to *Leptocheirus* sp. (28-day exposure) or the polychaete *Neanthes* sp. (21-day exposure) related to mercury at concentrations ranging from 0.3 to 4.6 mg/kg (Robinson *et al.* 1997). The sediments of Lavaca Bay contain a high proportion of fine-grain material, but a relatively low concentration of organic carbon (0.5–1% organic carbon; Locarnini and Presley 1996).

In the present study, the lack of mercury-related adverse effects indicates that the bioavailable fraction of the total sediment concentration of mercury was minimal, less than the effects threshold for *H. azteca* and *L. plumulosus*. The lack of mercury-related toxicity in the test sediments is further illustrated by compiling the results of the dilution and follow-up studies (Figure 2) to show that the distribution of mercury concentrations associated with toxicity is essentially the same as the distribution of concentrations associated with no toxicity. The lack of a concentration-response relationship between mercury concentrations and toxicity test results suggests that a site-specific sediment effects threshold for mercury may be higher than 4.1 mg/kg.

The extent to which organic carbon and AVS concentrations account for the observed lack of mercury-related toxicity cannot be determined from this study. The concentrations of AVS measured in the follow-up study were much greater than those of SEM mercury, indicating that if the detected SEM mercury were present as the mercuric ion, the formation of sulfide complexes would greatly reduce its bioavailability (Di Toro *et al.* 1990; Ankley *et al.* 1996). The bioavailability of other forms of mercury, such as methylmercury, is not predictable based on SEM and AVS results. However, sulfide is known to inhibit mercury methylation (Benoit *et al.* 1999), and methylmercury can form strong complexes with sulfide (Faust 1992), as well as sulfhydryl groups in organic matter (Loux 1999).

Because methylmercury was not measured in this study, the possibility that methylmercury, rather than total mercury, contributed to observed toxicity cannot be completely eliminated. However, in *L. plumulosus* toxicity tests using Bruns-

wick estuary sediments, PTI (1998) demonstrated a better concentration-response relationship based on total mercury than based on methylmercury concentrations, although total mercury and methylmercury levels were generally correlated. Perhaps similar to the present study, toxicity tests conducted using Lavaca Bay sediments showed minor but statistically significant reductions in test organism growth that were not correlated with either total or methylmercury concentrations; these ''effects'' appeared to represent toxicity test artifacts based on a lack of apparent impacts on benthic community quality (Parametrix 1997). Though methylmercury is the primary mercury species of concern with regard to bioaccumulation and potential impacts on higher trophic levels, it is reasonable to expect that methylmercury is less important with regard to direct toxicity. A small number of experiments comparing the aquatic toxicity of methylmercury and inorganic mercury suggest that methylmercury may be approximately 50 times as toxic as inorganic mercury (Biesinger *et al.* 1982; Hempel *et al.* 1995). However, concentrations of inorganic forms of mercury are typically 200 times higher than methylmercury in marine and estuarine sediments (Gilmour and Henry 1991; Kannan and Falandysz 1998). Therefore, the overall contribution of methylmercury to the direct toxicity of total mercury may be minor.

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