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**Red Devil Creek Benthic
Macroinvertebrate Metals Data
Used to Develop Trophic Transfer
Factors**



H Red Devil Creek Benthic Macroinvertebrate Metals Data Used to Develop Trophic Transfer Factors

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Appendix H

Red Devil Creek Benthic Macroinvertebrate Metals Data Used to Develop Trophic Transfer Factors

This appendix includes a summary of the metals data for composite benthic-macroinvertebrate samples collected from Red Devil Creek by the United States Department of Interior Bureau of Land Management (BLM) in 2010 and 2011 (see Tables H-1 and H-2). The exposure point concentrations developed from these data (see Table H-3) were used in the Baseline Ecological Risk Assessment (BERA) Supplement to develop benthos-to-sculpin trophic transfer factors (see Appendix I).

Table H-1. Red Devil Creek Benthic Macroinvertebrate Sample Composition (from E&E 2014, Appendix N)

| Dataset | Client Sample ID | Order | Family | Genus | Number of Individuals | Wet Wt. (grams) | Functional Feeding Guild |
|---------------|--------------------------|---------------|---------------|-----------|-----------------------|-----------------|--------------------------|
| June 2010 | RED DEVIL 1/Macro | Ephemeroptera | Baetidae | Baetis | 406 | 1.2 | Collector |
| June 2010 | RED DEVIL 2/Macro | Ephemeroptera | Baetidae | Baetis | 270 | 1.2 | Collector |
| June 2010 | RED DEVIL 3/Macro | Ephemeroptera | Baetidae | Baetis | 425 | 1.25 | Collector |
| Aug 2010 | 2-RD-1 R. Devil CK-macro | Ephemeroptera | Heptageniidae | Cinygmula | 125 | 1.00 | Scraper |
| Aug 2010 | 2-RD-2 R. Devil CK-macro | Ephemeroptera | Heptageniidae | Cinygmula | 176 | 1.03 | Scraper |
| Aug 2010 | 2-RD-3 R. Devil CK-macro | Ephemeroptera | Heptageniidae | Cinygmula | 149 | 1.10 | Scraper |
| RDC June 2011 | RDMACR01-1 | Ephemeroptera | Baetidae | Baetis | 390 | 1.12 | Collector |
| RDC June 2011 | RDMACR01-2 | Plecoptera | Nemouridae | Zapada | 106 | 0.55 | Facultative shredder |
| RDC June 2011 | RDMACR01-3 | Ephemeroptera | Baetidae | Baetis | 400 | 1.13 | Collector |
| RDC Sept 2011 | RDMACRO2-1 | Plecoptera | Nemouridae | Zapada | 937 | 4.28 | Facultative shredder |

Table H-2. Benthic Macroinvertebrate Metals Data from Red Devil Creek Used in BERA and BERA Supplement (from E&E 2014, Appendix N)

| Dataset | Lab ID | Client Sample ID | Sb (mg/kg wet) | | As (mg/kg wet) | | Ba (mg/kg wet) | | Be (mg/kg wet) | | Cd (mg/kg wet) | | Cr (mg/kg wet) | | Cu (mg/kg wet) | | Fe (mg/kg wet) | |
|---------------|------------|-------------------|----------------|---|----------------|---|----------------|---|----------------|---|----------------|---|----------------|---|----------------|---|----------------|----|
| | | | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q |
| June 2010 | 263 | RED DEVIL 1/Macro | 20.389 | | 81.238 | | 4.843 | | 0.025 | U | 0.116 | | 0.441 | | 6.564 | | 761.3 | J- |
| June 2010 | 264 | RED DEVIL 2/Macro | 18.953 | | 98.798 | | 5.907 | | 0.025 | U | 0.082 | | 0.327 | | 10.384 | | 781.1 | J- |
| June 2010 | 265 | RED DEVIL 3/Macro | 21.437 | | 126.444 | | 6.612 | | 0.025 | U | 0.097 | | 0.368 | | 12.405 | | 974 | J- |
| RDC June 2011 | 1110262-10 | RDMACR01-1 | na | | 235 | | 8.82 | | 0.066 | U | 0.084 | | 0.52 | | 7.55 | | 1670 | |
| RDC June 2011 | 1110262-11 | RDMACR01-2 | na | | 29.1 | | 2.08 | | 0.076 | U | 0.003 | U | 0.06 | U | 7.9 | | 305 | |
| RDC June 2011 | 1110262-12 | RDMACR01-3 | na | | 144 | | 7.7 | | 0.064 | U | 0.085 | | 0.5 | | 6.93 | | 1190 | |
| RDC Sept 2011 | 1110264-17 | RDMACRO2-1 | na | | 277 | | 14.6 | | 0.065 | U | 0.025 | | 0.67 | | 8.75 | | 2570 | |

| Dataset | Lab ID | Client Sample ID | Pb (mg/kg wet) | | Mn (mg/kg wet) | | Hg (mg/kg wet) | | Ni (mg/kg wet) | | Se (mg/kg wet) | | V (mg/kg wet) | | Zn (mg/kg wet) | |
|---------------|------------|-------------------|----------------|---|----------------|---|----------------|---|----------------|---|----------------|---|---------------|---|----------------|----|
| | | | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q | Result | Q |
| June 2010 | 263 | RED DEVIL 1/Macro | 0.146 | | 27.841 | | 2.01 | | 0.557 | | 1.002 | | 0.397 | | 22.551 | J- |
| June 2010 | 264 | RED DEVIL 2/Macro | 0.131 | | 41.995 | | 2.38 | | 1.257 | | 3.386 | | 0.433 | | 40.575 | J- |
| June 2010 | 265 | RED DEVIL 3/Macro | 0.154 | | 50.779 | | 1.6 | | 1.409 | | 4.046 | | 0.472 | | 44.92 | J- |
| RDC June 2011 | 1110262-10 | RDMACR01-1 | 0.169 | | 51.1 | | 0.372 | | 1.25 | | 2.58 | | 0.626 | | 48.6 | |
| RDC June 2011 | 1110262-11 | RDMACR01-2 | 0.005 | U | 9 | | 0.217 | | 0.538 | | 1.33 | | 0.05 | U | 36.2 | |
| RDC June 2011 | 1110262-12 | RDMACR01-3 | 0.178 | | 37.3 | | 0.375 | | 0.997 | | 1.92 | | 0.566 | | 44.6 | |
| RDC Sept 2011 | 1110264-17 | RDMACRO2-1 | 0.333 | | 164 | | 2.41 | | 2.96 | | 0.12 | U | 1.09 | | 27.6 | |

| Dataset | Lab ID | Client Sample ID | Methyl Hg (mg/kg wet) | |
|---------------|-------------|--------------------------|-----------------------|---|
| | | | Result | Q |
| June 2010 | 1007-189-41 | RED DEVIL 1/Macro | 0.0238 | |
| June 2010 | 1007-189-42 | RED DEVIL 2/Macro | 0.0594 | |
| June 2010 | 1007-189-43 | RED DEVIL 3/Macro | 0.0504 | |
| Aug 2010 | 1009071-10 | 2-RD-1 R. Devil CK-macro | 0.131 | |
| Aug 2010 | 1009071-11 | 2-RD-2 R. Devil CK-macro | 0.0706 | |
| Aug 2010 | 1009071-12 | 2-RD-3 R. Devil CK-macro | 0.0587 | |
| RDC June 2011 | 1110262-10 | RDMACR01-1 | 0.0324 | |
| RDC June 2011 | 1110262-11 | RDMACR01-2 | 0.0826 | |
| RDC June 2011 | 1110262-12 | RDMACR01-3 | 0.0271 | |
| RDC Sept 2011 | 1110264-17 | RDMACRO2-1 | 0.0304 | |

Key:

BERA = baseline ecological risk assessment

J = estimated value

na = not analyzed

Q = Qualifier

RDC = Red Devil Creek

U = not detected



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Table H-3. Benthic Macroinvertebrate Composite Sample EPCs Used in Red Devil Mine Site BERA and BERA Supplement (from E&E 2014, Appendix O).

| Data Set | Analyte | Units | Number of Observations | Number of Detections | Mean of Detected | SD of Detected | Maximum Detected | Distribution (detects only) | UCL Statistic | 95% UCL | EPC | EPC Source |
|----------|---------------|---------|------------------------|----------------------|------------------|----------------|------------------|-----------------------------|---------------------------|---------|--------|------------|
| Benthos | Antimony | mg/kg W | 3 | 3 | 20.2596667 | 1.24704023 | 21.437 | -- | -- | -- | 21.437 | Max Det. |
| Benthos | Arsenic | mg/kg W | 7 | 7 | 141.7 | 87.01 | 277 | Normal | 95% Student's-t UCL | 205.6 | 205.6 | 95% UCL |
| Benthos | Barium | mg/kg W | 7 | 7 | 7.223 | 3.903 | 14.6 | Normal | 95% Student's-t UCL | 10.09 | 10.09 | 95% UCL |
| Benthos | Beryllium | mg/kg W | 7 | 0 | -- | -- | -- | -- | -- | -- | -- | -- |
| Benthos | Cadmium | mg/kg W | 7 | 6 | 0.0815 | 0.0305 | 0.116 | Normal | 95% KM (t) UCL | 0.0995 | 0.0995 | 95% UCL |
| Benthos | Chromium | mg/kg W | 7 | 6 | 0.471 | 0.123 | 0.67 | Normal | 95% KM (t) UCL | 0.543 | 0.543 | 95% UCL |
| Benthos | Copper | mg/kg W | 7 | 7 | 8.64 | 2.09 | 12.41 | Normal | 95% Student's-t UCL | 10.18 | 10.18 | 95% UCL |
| Benthos | Lead | mg/kg W | 7 | 6 | 0.185 | 0.0743 | 0.333 | Lognormal | 95% KM (Chebyshev) UCL | 0.296 | 0.296 | 95% UCL |
| Benthos | Manganese | mg/kg W | 7 | 7 | 54.57 | 50.41 | 164 | Gamma | 95% Approximate Gamma UCL | 111.1 | 111.1 | 95% UCL |
| Benthos | Mercury | mg/kg W | 7 | 7 | 1.338 | 0.989 | 2.41 | Normal | 95% Student's-t UCL | 2.064 | 2.064 | 95% UCL |
| Benthos | Methylmercury | mg/kg W | 10 | 10 | 0.0566 | 0.0328 | 0.131 | Normal | 95% Student's-t UCL | 0.0756 | 0.0756 | 95% UCL |
| Benthos | Nickel | mg/kg W | 7 | 7 | 1.281 | 0.816 | 2.96 | Normal | 95% Student's-t UCL | 1.88 | 1.88 | 95% UCL |
| Benthos | Selenium | mg/kg W | 7 | 6 | 2.377 | 1.187 | 4.046 | Normal | 95% KM (t) UCL | 3.076 | 3.076 | 95% UCL |
| Benthos | Vanadium | mg/kg W | 7 | 6 | 0.597 | 0.256 | 1.09 | Normal | 95% KM (t) UCL | 0.752 | 0.752 | 95% UCL |
| Benthos | Zinc | mg/kg W | 7 | 7 | 37.86 | 9.664 | 48.6 | Normal | 95% Student's-t UCL | 44.96 | 44.96 | 95% UCL |

Key:

BERA = baseline ecological risk assessment

EPC = exposure point concentration

KM = Kaplan-Meier

Max det. = maximum detected concentration

mg/kg W= milligrams per kilogram (wet weight)

RDM = Red Devil Mine

SD = standard deviation

UCL = upper confidence limit (on average concentration)



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