

**I.2**

**SIDERITE LEACHATE EVALUATION**

## **APPENDIX I.2**

### **SIDERITE LEACHATE EVALUATION**

Testing was conducted to evaluate potential water quality impacts during and after placement of siderite as part of an amended sediment cap. This included bulk chemical analyses for general characterization, modified elutriate testing (MET), and sequential batch leach testing (SBLT) (Parsons, 2009).

The MET evaluation was completed to evaluate potential impacts during material placement. Siderite was mixed with distilled/deionized water, and water samples were collected and analyzed following a 24-hour settlement period. The supernatant was analyzed for total and dissolved target analyte list (TAL) metals, semivolatiles (EPA Method 8260), total cyanide, hardness, pH, and total suspended solids. For dissolved concentrations, an aliquot of the supernatant was centrifuged prior to analysis.

Results from the MET testing (Parsons, 2009) verify that water quality impacts from siderite during cap placement will not be a concern. As shown in Table I.2-1, there were no exceedances of NYSDEC acute surface water quality criteria. Any impacts to water quality would be minor, localized and dissipate rapidly following material placement.

The SBLT was designed to evaluate leaching of constituents from siderite by upwelling porewater following cap placement. SBLT testing was conducted using porewater from the in-lake waste deposit (ILWD), which is the area where siderite is proposed in the initial design as part of the sediment cap. SBLT testing was completed on powdered, pelletized and granular siderite. For each of the three forms of siderite ILWD porewater and siderite amendment were added to a container at a liquid to solid ratio of 4:1 and tumbled for 24 hours. The leachate was then removed by centrifugation and decanting. The porewater was replaced and the mixture placed on the tumbler for another 24 hours, after which the porewater was decanted again. This procedure was repeated for a total of four cycles. The initial porewater and leachates from each cycle were analyzed for TAL metals, semivolatiles, total cyanide, pH, and total suspended solids were also measured. Subsequent design evaluations as discussed in the Initial Design Submittal (IDS) indicate that the amended cap will use granular siderite. Therefore, the discussion below focuses on the results from the granular siderite testing.

SBLT test results verify that there would be no significant long-term impacts resulting from porewater migration through the siderite. Table I.2-2 compares the SBLT leachate analyte concentrations with the ILWD porewater in order to identify potential contributions from siderite. As shown in Table I.2-2, the majority of analytes were not detected or actually showed decreased concentrations in the leachate, perhaps as a result of precipitation, such as for mercury and vanadium. There were some metals, such as aluminum and zinc, which showed variability, or at most, potentially minor increases in comparison to the ILWD porewater. The only metal which showed consistently elevated concentrations in the leachate was cobalt. However, the average concentration of cobalt in the leachate was approximately 6.4 ug/L, which only slightly

exceeds the NYSDEC chronic surface water criteria of 5 ug/L. Any metals contribution to the cap porewater would be minor and would be quickly attenuated by the overlying sediment cap.

Semivolatile organic compounds were also analyzed for in the leachate, primarily to identify any impacts due to the manufacturing process associated with the pelletized siderite, which is no longer under consideration. Bis(2-ethylhexyl)phthalate (BEHP) was detected sporadically at low levels in the leachate from all forms of siderite. BEHP is a common laboratory or sample handling artifact. It is used as a plasticizer and may be derived from materials that the siderite samples were in contact with during shipping or sample processing. It would not be expected to be present in granular siderite.

## **REFERENCES**

- Parsons, 2009. Onondaga Lake Pre-Design Investigation: Phase IV Work Plan – Addendum 7 Cap pH Amendment Evaluation Addendum.
- Parsons, 2009. Onondaga Lake Pre-Design Investigation: Draft Phase IV Data Summary Report Appendix H Cap pH Amendment Study
- <http://www.dec.ny.gov/regs/4590.html>

**Table I.2-1  
Modified Elutriate Test Results Compared to NYSDEC Class C Water Quality Standards**

| Parameter                   | Units | Elutriate Blank <sup>1</sup> | Granular Siderite (Sidco) |        |        | Acute Aquatic Standard |
|-----------------------------|-------|------------------------------|---------------------------|--------|--------|------------------------|
|                             |       |                              | Rep 1                     | Rep 2  | Rep 3  |                        |
| <b>Metals</b>               |       |                              |                           |        |        |                        |
| Aluminum (dissolved)        | ug/L  | 23.4 B                       | 212 B                     | 177 B  | 1,190  | NS                     |
| Arsenic (dissolved)         | ug/L  | <2                           | <2                        | <2     | <2.7   | 340                    |
| Beryllium (total)           | ug/L  | 0.4 B                        | 6.6 B                     | 4.5 B  | 6.2    | NS                     |
| Cadmium (dissolved)         | ug/L  | <0.21                        | <0.21                     | <0.21  | 0.19 J | 15.7 <sup>2</sup>      |
| Chromium (dissolved)        | ug/L  | <1.1                         | <1.1                      | <1.1   | 2.1 J  | 1,580 <sup>2</sup>     |
| Cobalt (total)              | ug/L  | <0.4                         | 173                       | 119    | 107    | NS                     |
| Copper (dissolved)          | ug/L  | <4.6                         | <4.6                      | <4.6   | <2.7   | 43.5 <sup>2</sup>      |
| Lead (dissolved)            | ug/L  | <1.7                         | <1.7                      | <1.7   | <1.3   | 366 <sup>2</sup>       |
| Mercury (dissolved)         | ug/L  | <0.038                       | <0.038                    | <0.038 | <0.038 | 1.4                    |
| Nickel (dissolved)          | ug/L  | <0.78                        | 107 B                     | 88.7 B | 40.4 B | 1,350 <sup>2</sup>     |
| Selenium (dissolved)        | ug/L  | <2.9                         | <2.9                      | <2.9   | <1.6   | NS                     |
| Silver (dissolved)          | ug/L  | <0.54                        | <0.54                     | <0.54  | <0.68  | NS                     |
| Thallium (total)            | ug/L  | <2.4                         | 4 J                       | 3.4 J  | <2.4   | NS                     |
| Vanadium (total)            | ug/L  | <1.9                         | 549                       | 353    | 632    | NS                     |
| Zinc (dissolved)            | ug/L  | <3.1                         | 212                       | 183    | 32.6 B | 337 <sup>2</sup>       |
| <b>Semivolatiles</b>        |       |                              |                           |        |        |                        |
| 2,4-Dichlorophenol          | ug/L  | <0.13                        | <0.13                     | <0.13  | <0.13  | NS                     |
| 2,4-Dimethylphenol          | ug/L  | <0.077                       | <0.078                    | <0.076 | <0.077 | NS                     |
| 2,4-Dinitrophenol           | ug/L  | <5.9                         | <6                        | <5.8   | <5.8   | NS                     |
| bis(2-Ethylhexyl) phthalate | ug/L  | 4.1 B                        | <0.45                     | <0.44  | 3 BJ   | NS                     |
| Hexachlorobenzene           | ug/L  | <0.17                        | <0.18                     | <0.17  | <0.17  | NS                     |
| Hexachlorobutadiene         | ug/L  | <0.12                        | <0.11                     | <0.11  | <0.11  | NS                     |
| Hexachlorocyclopentadiene   | ug/L  | <0.11                        | <0.11                     | <0.11  | <0.11  | NS                     |
| Hexachloroethane            | ug/L  | <0.077                       | <0.074                    | <0.073 | <0.072 | NS                     |
| Pentachlorophenol           | ug/L  | <1.8                         | <1.8                      | <1.8   | <1.8   | 10.5 <sup>2</sup>      |
| Phenol                      | ug/L  | <0.24                        | <0.23                     | <0.22  | 9.8    | NS                     |
| <b>Other</b>                |       |                              |                           |        |        |                        |
| Cyanide                     | ug/L  | <1.5                         | <1.5                      | <1.5   | <1.5   | 22                     |
| pH                          | su    | 5                            | 5.3                       | 5.4    | 5.7    | NS                     |

**Notes:**

- 1: Elutriate blank is DI water with a pH of 5
  - 2: Water quality standard is pH and/or hardness dependent. Standard calculated using the lowest reported hardness (348 mg/L) and pH (7.18) from 2006 monitoring data, Onondaga Lake Ambient Monitoring Program
- < - result is non-detect at the reported method detection limit (MDL)
- J - estimated value, result is less than the reporting limit (RL) but greater than the MDL
- B - analyte detected in associated laboratory blank
- NS - no standard

Table I.2-2  
Sequential Batch Leach Test Results for Granular Siderite (Sidco)

| Parameter                   | Units | SBLT Solution <sup>1</sup> | Rep 1         |               |               |               | Rep 2         |               |               |               |
|-----------------------------|-------|----------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                             |       |                            | Leach Cycle 1 | Leach Cycle 2 | Leach Cycle 3 | Leach Cycle 4 | Leach Cycle 1 | Leach Cycle 2 | Leach Cycle 3 | Leach Cycle 4 |
| <b>Metals</b>               |       |                            |               |               |               |               |               |               |               |               |
| Aluminum (dissolved)        | ug/L  | 23.1 BJ                    | 33.4 BJ       | 26.3 BJ       | <9.7          | 20.6 J        | 46.6 BJ       | 26.3 BJ       | <9.7          | 13 J          |
| Arsenic (dissolved)         | ug/L  | 13.6                       | 6.2 J         | 7.4 J         | 5 J           | 8 J           | 5.8 J         | 7.4 J         | 8.7 J         | 5.8 J         |
| Beryllium (total)           | ug/L  | 0.8 J                      | 0.75 J        | 1.1 J         | 0.83 J        | 0.65 J        | 0.75 J        | 1.1 J         | 0.89 J        | 0.69 J        |
| Cadmium (dissolved)         | ug/L  | <0.13                      | <0.13         | <0.13         | <0.13         | <0.13         | 1.1 J         | <0.13         | <0.13         | <0.13         |
| Chromium (dissolved)        | ug/L  | <0.57                      | 0.67 J        | 1.6 J         | 1.6 J         | 5.3           | 1.3 J         | 0.94 J        | 1.2 J         | 2.6 J         |
| Cobalt (total)              | ug/L  | 1.5 J                      | 15.9 J        | 4.6 J         | 2.7 J         | 3.2 J         | 13.2 J        | 4.6 J         | 3.5 J         | 3.4 J         |
| Copper (dissolved)          | ug/L  | <2.7                       | 3.8 J         | 4.8 J         | <2.7          | 12.3 J        | 5.7 J         | 4.8 J         | <2.7          | <2.7          |
| Lead (dissolved)            | ug/L  | <6.3                       | <6.3          | <6.3          | <6.3          | <6.3          | <6.3          | <6.3          | <6.3          | <6.3          |
| Mercury (dissolved)         | ug/L  | 26.2                       | <0.038        | <0.038        | 0.046 J       | 0.095 J       | <0.038        | <0.038        | 0.048 J       | 0.076 J       |
| Nickel (dissolved)          | ug/L  | 167                        | 245           | 248           | 200           | 185           | 268           | 243           | 206           | 181           |
| Selenium (dissolved)        | ug/L  | 5.7                        | 8.1           | 8.5           | 6.1           | 6.2           | 7.5           | 5.2           | 6.6           | 3.7 J         |
| Silver (dissolved)          | ug/L  | <0.68                      | <0.68         | <0.68         | <0.68         | <0.68         | <0.68         | <0.68         | <0.68         | <0.68         |
| Thallium (total)            | ug/L  | <2.4                       | <2.4          | <2.4          | <2.4          | <2.4          | <2.4          | <2.4          | <2.4          | <2.4          |
| Vanadium (total)            | ug/L  | 2.2 J                      | <1.9          | <1.9          | <1.9          | <1.9          | 2.9 J         | <1.9          | <1.9          | <1.9          |
| Zinc (dissolved)            | ug/L  | 11.4 BJ                    | 11.7 BJ       | 24 BJ         | 30.3 B        | 41.4 J        | 22.9 B        | 13.7 BJ       | 13.8 BJ       | 12 BJ         |
| <b>Semivolatiles</b>        |       |                            |               |               |               |               |               |               |               |               |
| 2,4-Dichlorophenol          | ug/L  | <0.2                       | <0.24         | <0.19         | <0.24         | <0.21         | <0.21         | <0.19         | <0.24         | <0.2          |
| 2,4-Dimethylphenol          | ug/L  | 7 J                        | 3.7 J         | 6.6 J         | 7.1 J         | 8 J           | 3.4 J         | 6.4 J         | 0.9 J         | 8.7 J         |
| 2,4-Dinitrophenol           | ug/L  | <9.1                       | <11           | <8.8          | <11           | <9.8          | <9.5          | <8.8          | <11           | <9            |
| bis(2-Ethylhexyl) phthalate | ug/L  | <0.69                      | 7.1 J         | 5.6 J         | <0.81         | 6.6 J         | 6.3 J         | 5.6 J         | <0.81         | 5.6 J         |
| Hexachlorobenzene           | ug/L  | <0.27                      | <0.32         | <0.26         | <0.32         | <0.29         | <0.28         | <0.26         | <0.32         | <0.27         |
| Hexachlorobutadiene         | ug/L  | <0.18                      | <0.21         | <0.17         | <0.21         | <0.21         | <0.19         | <0.17         | <0.21         | <0.21         |
| Hexachlorocyclopentadiene   | ug/L  | <0.17                      | <0.2          | <0.16         | <0.2          | <0.18         | <0.18         | <0.16         | <0.2          | <0.17         |
| Hexachloroethane            | ug/L  | <0.11                      | <0.13         | <0.11         | <0.13         | <0.12         | <0.12         | <0.11         | <0.13         | <0.11         |
| Pentachlorophenol           | ug/L  | <2.8                       | <2.9          | <2.7          | <3.3          | <3            | <2.8          | <2.7          | <3.3          | <2.8          |
| Phenol                      | ug/L  | 520                        | 420           | 570 J*        | 520           | 580           | 410           | 540           | 71            | 650           |
| <b>Other</b>                |       |                            |               |               |               |               |               |               |               |               |
| Total Cyanide               | ug/L  | 696                        | 135           | 28.7          | 22.8          | 36            | 136           | 19.4          | 11.5          | 32.6          |
| pH                          | s.u.  | 11.8                       | 8.1           | 7.1           | 6.8           | 7.4           | 8.2           | 7.2           | 7.4           | 7.1           |

Notes:

- 1: SBLT blank solution is porewater collected from location TR-03A.
- < - result is non-detect at the reported method detection limit (MDL)
- J - estimated value, result is less than the reporting limit (RL) but greater than the MDL
- B - analyte detected in associated laboratory blank