**MEMORANDUM**

**To:** EPA

**Copy To:** File 80021

**From:** J. Lambert, J. Brunelle

**Subject:** Olin: OU1/OU2 Remedial Investigation Appendix J review

**Date:** 11/5/19

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Nobis Group® (Nobis) on behalf of the U.S. Environmental Protection Agency (EPA), has reviewed Appendix J of the Operable Unit (OU)1/OU2 Remedial Investigation (RI) (AMEC Environment & Infrastructure, Inc. [AMEC], 2015) for the Olin Chemical Superfund Site (Site) in Wilmington, Massachusetts (Wood, 2019). Appendix J provides an evaluation of potential leaching from OU1 soils to groundwater.

## 1.0 APPENDIX J SUMMARY

AMEC (2015) compared the surface and subsurface soils (up to 10 feet bgs [bgs]) to shallow groundwater concentrations and to EPA Regional Screening Level (RSL) soil screening levels (SSLs). AMEC first compared soil concentrations to groundwater concentrations, and then used the SSLs as supplemental evaluation. Deeper soil impacts were not evaluated, as those were to be considered and addressed in the OU3 RI.

Olin used groundwater data summaries to identify parameters that were detected in more than 5 samples in both soil and groundwater:

- Total trimethylpentenes (TMPs): AMEC suggested that the TMPs in groundwater were related to liquid disposal or dense aqueous phase liquid (DAPL); however, Figure 1-1 shows high concentrations in groundwater associated with soil concentrations, particularly in the vicinity of Plant B.
- Bis(2-ethylhexyl)phthalate (BEHP): AMEC suggested that the low concentrations in groundwater (below the MCL) indicated that BEHP in soil was not a significant source of contamination in leaching. Figure 1-2 did show BEHP groundwater concentrations associated with high soil concentrations north of the Containment Area and at Plant B.
- n-Nitrosodphenylamine (NDPA): AMEC suggested that the low concentrations in groundwater is related to Plant B liquid releases, not soil. Figure 1-3 appears to show that



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higher groundwater concentrations are not correlated with relatively high soil concentrations.

- Calcium (Figure 1-4), ammonia (Figure 1-6) and sulfate (Figure 1-7): AMEC suggested that these distributions are related to DAPL rather than soil. However, these figures show that the highest concentrations in these areas are associated with the area south and east of the Containment Area and do not appear to be directly correlated with DAPL. These parameters had relatively few soil samples.
- Chromium (Figure 1-5): AMEC concluded that chromium concentrations in soil and groundwater were trivalent, and therefore that leaching was not a concern.
- Hydrazine (Figure 1-8): AMEC concluded that hydrazine concentrations in soil and groundwater indicated potential limited leaching of hydrazine.

## 2.0 ANALYSIS AND CONCERNS

We have concerns regarding Appendix J, as described in the subsections below:

### 2.1 Additional Analytes

Olin evaluated only the list of contaminants indicated above; however, several additional contaminants were detected in both soil and groundwater and were not included in their evaluation, likely because Olin developed its list based on detection frequency *and* site history.

Contaminants that Olin did not include in the evaluation that were detected in soils from 1-10' bgs and groundwater at the target frequencies include carbon disulfide, benzoic acid, diphenyl ether, most metals, and volatile petroleum hydrocarbons (VPH). These should not be ruled out of the evaluation. Table 1 provides a simplified version of Table 1-2 of Appendix J that includes all analytes with more than 5 detections in both shallow groundwater and soil from 1-10 feet bgs.

### 2.2 Human Health and Ecological Concerns

Appendix J evaluated the potential leachability of soil to groundwater; however, it did not evaluate the potential human health or ecological impacts of that groundwater, as groundwater was to be evaluated in the OU3 (groundwater) RI. Table 1 modifies the data provided in Table 1-2 of Appendix J to include a comparison to screening criteria for groundwater (based on both human health and ecological risk, assuming groundwater may migrate to the East Ditch or South Ditch).

### 2.3 Soil Screening Criteria

Appendix J indicates that drinking water screening criteria (e.g. RSL-based SSLs and tapwater criteria) should only be applied to the northeastern portion of the property. We do not agree. RSLs

and MCLs should be retained for comparison purposes to evaluate leaching and initial screening of groundwater impacts.

Appendix J also indicates that the SSLs used for soil screening are too conservative, particularly for those applicable to tapwater RSLs (which are a conservative screening value). AMEC's alternate method of comparing frequently-detected shallow soil concentrations (less than 10 feet bgs) and shallow groundwater concentrations is reasonable in lieu the SSL/RSL approach.

Appendix J also states that SSLs were to be used as secondary criteria for evaluation; however, they did not appear to use SSLs for any level of evaluation. If used as a secondary screening criteria (as shown in Table 1), carbon disulfide and beryllium, that were detected in both soil and groundwater and exceed screening criteria in groundwater, may be screened out as a potential leaching concern because they don't exceed the soil leachability SSL. Other analytes should be retained as potential concerns for groundwater.

## 3.0 RECOMMENDATIONS

In order to rule out leaching as a potential source of contamination to groundwater, Olin should expand the analysis in Appendix J to include the following contaminants in addition to the ones currently included:

- Diphenyl ether
- Aluminum
- Antimony
- Arsenic
- Cadmium
- Cobalt
- Copper
- Iron
- Manganese
- Mercury
- Nickel
- Vanadium
- Zinc

As part of this analysis, Olin may also provide an evaluation to justify exclusion of contaminants determined to be not site related. Olin should also update all figures to include isoconcentration maps for shallow groundwater based on multiples of the applicable RSL.

## 4.0 REFERENCES

AMEC, 2015. Final Remedial Investigation Report, Operable Unit 1 & Operable Unit 2, Olin Chemical Superfund Site, Wilmington, Massachusetts. July 24.

Table 1
Summary: Analytes with 6+ Soil and Groundwater Detections
Olin Chemical Superfund Site


| Parameter | 1-10' bgs Soil (mg/kg) | | | | On-Property Shallow Groundwater (mg/L) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Detect Freq. | Max Detected | Average Conc. | RSL-based SSL | Detect Freq. | Max Detected | Average Conc. | RSL | MCL | SW Eco | SW Eco Source |
| VOCs | | | | | | | | | | | |
| 2,4,4-Trimethyl-1-pentene[5] | 73/263 | 1200 | 12 | 0.022 | 40/112 | 1.7 | 0.18 | 0.0065 | -- | 0.015 | BERA |
| 2,4,4-Trimethyl-2-pentene[5] | 62/260 | 310 | 3 | 0.022 | 34/112 | 0.49 | 0.05 | 0.0065 | -- | 0.018 | BERA |
| *Carbon disulfide* | *7/188* | *0.013* | *0.1* | *0.024* | *9/79* | *0.01* | *0.0049* | *0.081* | -- | *0.015* | *GLI* |
| SVOCs | | | | | | | | | | | |
| *Benzoic Acid* | *16/360* | *2.1* | *15.4* | *1.5* | *6/44* | *0.0017* | *0.0021* | *7.5* | -- | *0.042* | *S&T* |
| Bis(2-Ethylhexyl)phthalate | 256/396 | 8600 | 120 | 1.3 | 15/112 | 0.012 | 0.0013 | 0.0056 | 0.006 | *0.008* | GLI |
| *Diphenyl ether* | *7/92* | *3.8* | *0.44* | *0.00034* | *24/79* | *0.14* | *0.0059* | *0.000083* | -- | *0.25* | *BERA* |
| N-Nitrosodiphenylamine | 73/396 | 3400 | 23 | 0.067 | 41/112 | 0.58 | 0.065 | 0.012 | -- | 0.025 | GLI |
| Inorganics | | | | | | | | | | | |
| *Aluminum* | *200/200* | *15000* | *4974* | *3000* | *82/114* | *17* | *0.56* | *2* | -- | 0.88 | *NRWQC* |
| *Antimony* | *12/153* | *41* | *3.1* | *0.035* | *8/81* | *0.0026* | *0.0034* | *0.00078* | *0.006* | *0.19* | *GLI* |
| *Arsenic* | *145/185* | *89* | *4.4* | *0.0015* | *35/81* | *0.026* | *0.0028* | *0.000052* | *0.01* | *0.15* | *NRWQC* |
| *Barium* | *148/151* | *75* | *15.2* | *16* | *79/81* | *0.21* | *0.032* | *0.38* | *2* | *0.22* | *GLI* |
| *Beryllium* | *95/153* | *0.47* | *0.31* | *1.9* | *15/81* | *0.0028* | *0.0006* | *0.0025* | *0.004* | *0.011* | *GLI* |
| *Cadmium* | *103/265* | *7.3* | *0.35* | *0.069* | *20/81* | *0.0053* | *0.00062* | *0.00092* | *0.005* | *0.00072* | *NRWQC* |
| Calcium | 144/145 | 3200 | 1732 | -- | 114/114 | 600 | 138 | -- | -- | 116000 | GLI |
| Chromium | 463/465 | 7900 | 321 | 4000000 | 23/114 | 0.065 | 0.005 | 2.2 | 0.1 | 0.074 | NRWQC |
| *Cobalt* | *134/145* | *14* | *2.7* | *0.027* | *32/81* | *0.04* | *0.008* | *0.0006* | -- | *0.019* | *GLI* |
| *Copper* | *128/153* | *47* | *7.1* | *2.8* | *16/81* | *0.33* | *0.012* | *0.08* | *1.3* | *0.0093* | *NRWQC* |
| *Iron* | *192/192* | *26000* | *6144* | *35* | *96/118* | *35* | *4.7* | *1.4* | -- | *1* | *NRWQC* |
| *Lead* | *206/265* | *52* | *5* | -- | *15/81* | *0.0088* | *0.003* | *0.015* | *0.015* | *0.0032* | *NRWQC* |
| *Magnesium* | *143/145* | *6700* | *1547* | -- | *81/81* | *18* | *3* | -- | -- | *82000* | *S&T* |
| *Manganese* | *145/145* | *340* | *67* | *2.8* | *112/114* | *7.3* | *1* | *0.043* | -- | *0.093* | *GLI* |
| *Mercury* | *24/205* | *7* | *0.1* | *0.0033* | *7/81* | *0.0003* | *0.00011* | *0.000063* | *0.002* | *0.00077* | *NRWQC* |
| *Nickel* | *138/153* | *52* | *6.4* | *2.6* | *65/114* | *0.045* | *0.0063* | *0.039* | -- | *0.052* | *NRWQC* |
| *Potassium* | *143/145* | *2700* | *696* | -- | *55/81* | *10* | *2.7* | -- | -- | *53* | *GLI* |
| *Sodium* | *101/154* | *25600* | *663* | -- | *114/114* | *200* | *20* | -- | -- | *680000* | *S&T* |
| *Vanadium* | *140/145* | *190* | *11.8* | *8.6* | *35/81* | *0.28* | *0.013* | *0.0086* | -- | *0.027* | *GLI* |
| *Zinc* | *151/153* | *84* | *16* | *37* | *42/81* | *1.2* | *0.075* | *0.6* | -- | *0.12* | *NRWQC* |
| *Chloride* | *28/126* | *170* | *24* | -- | *280/280* | *510* | *54* | -- | -- | *230* | *NRWQC* |

Note:
1. *Italics* indicate parameters not included in Appendix J evaluation
2. Highlighting indicates that maximum value exceeds selected criterion.
3. RSL based on 10-6 cancer risk and HQ= 0.1
4. Surface water ecological criteria based on the following priority: chronic freshwater NRWQC, then GLI (Great Lakes Initiative Tier II values), then S&T (Suter & Tsao Tier II chronic), then BERA (other value derived in 2015 BERA). Site specific NRWQ for aluminum based on TOC 11 mg/L, hardness 177 mg/L, pH 7; for copper based on hardness of 100 mg/L
5. Trimethylpentenes based on total value