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SUMMARY MEMORANDUM –FINAL

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Subject: Summary of the PFOSA Sample Analysis Comparison – Coakley Landfill

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Disparate perfluorooctane sulfonamide (PFOSA) results exist for groundwater (GW) collected from the Coakley Landfill and analyzed for per- and polyfluoroalkyl substances (PFAS) by Alpha Analytical, Inc. (Alpha) in fall 2019, and Vista Analytical Laboratory, Inc. (Vista) in spring and fall 2020. Other PFAS compound results generally agree amongst the same data sets. Environmental Standards, Inc. (Environmental Standards) evaluated these data sets to determine, if possible, the reason for the disparate Alpha and Vista PFOSA results. The review focused on information for PFOSA, perfluorooctane sulfonic acid (PFOS, as it is known for PFOSA to degrade to PFOS), and potential precursors from both the laboratory reports and the laboratory standard operating procedures (SOPs).

Based on the review, there were many important similarities between the laboratories' approach to PFOSA analysis. In addition to being both analyzed by liquid chromatography with tandem mass spectrometry, both laboratories use the same quantitation/primary ion transition, qualitative/confirmation ion transition, and isotopically labeled pre-extraction internal standard compound and ion transition, which are critical for comparability. The laboratories were also similar in the types of quality control (QC) performed. The laboratories did have a few differences in their procedures, including the type of calibration curve fits used, a few extraction steps, limits used to evaluate QC and the approach to integrating and quantitating the branched and linear isomers of PFOS. However, these differences did not explain the disparity in the PFOSA concentrations between the two laboratories based on the review.

Based on the 2019/2020 data evaluation, it was recommended that split sample analysis be performed at several sample locations with prior PFOSA detection. In addition, it was recommended that a sub-set of samples be spiked with a PFOSA standard to provide positive control samples during the split sample event. A split and spiked sample study was designed and documented in the "PFOSA Investigation Replicate Sampling Work Plan, Coakley Landfill Superfund Site – Greenland and North Hampton, New Hampshire; NHDES Site #198712001" (Haley Ward, Inc., May 6, 2021). The study was conducted in May 2021.

In the study, Vista consistently detected PFOSA in the unspiked samples (except for the field blank and one investigative sample) while Alpha consistently did not. Both laboratories detected

PFOSA in the spiked samples. The spiked field blank recoveries were very similar between the two laboratories with 82.8% for Vista and 80.5% for Alpha. Acceptable recoveries (83 to 96%) were observed for the Alpha PFOSA results in the spiked field samples based on their results showing no background level of PFOSA; while unacceptable recoveries (-25 to 66%) were observed at Vista when calculated with the background levels they reported. The PFOSA results in the spiked field samples were at levels comparable to the spiked amount (~50 ng/L) such that the Alpha and Vista recoveries would be similar if it was assumed that no PFOSA was present in the background samples (as reported by Alpha). In both sets of samples, Alpha had higher PFOS results than Vista in many of the samples, but not to the point to explain the PFOSA detections at Vista, if a transformation was happening solely between PFOS and PFOSA. Alpha also had a trace-level detection of PFOS in the spiked field blank although PFOS was not-detected in the unspiked field blank. Additional precursor compounds were not detected except for low levels of NEtFOSAA at Alpha in both the spiked and unspiked samples collected at one location (4-5 ng/L).

The split sample results indicated that the difference in PFOSA results at the two laboratories were not due to site conditions that were influenced by spatial differences in collection time, as the same type of PFOSA result differences were observed in the 2021 split sample results as was observed in the 2019 vs 2020 data. In addition, the split field blank results indicated that there was not likely a PFOSA contamination issue at Vista as PFOSA was not detected in the unspiked field blank. The positive control samples indicated that there was not an issue of detection of PFOSA at Alpha (at concentrations near the spike amount of ~50 ng/L). The lack of detection of PFOSA in the unspiked field blank at both laboratories indicates that the phenomenon is related to the site sample matrix.

The inconsistency of the PFOSA results at Vista may indicate that there is an inconsistent level of transformation (that may or may not involve a non-target compound) or volatilization happening in the samples analyzed by Vista prior to extraction, perhaps one that is influenced by the various concentration levels of the compounds involved. If occurring, the level of PFAS transformation and/or volatilization may be influenced by shipping (*e.g.,* air to Vista vs ground to Alpha, which may involve differences in pressure and temperature during travel), storage (once at the laboratories, samples are stored at < 6°C), and/or laboratory treatment of the samples. Draft US EPA Method 1633 includes a reference to a published article (Million B. Woudneh, Bharat Chandramouli, M.C. Hamilton, and Richard Grace, 2019, Effect of Sample Storage on the Quantitative Determination of 29 PFAS: Observation of Analyte Interconversions during Storage. *Environ. Sci. Technol* 53:12576-12585) that suggested some PFAS can transform even during refrigerated storage of aqueous samples. The method requires aqueous samples to be stored at ≤ -20°C upon receipt at the laboratory and notes that certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids may transform to other PFAS when stored at 0-6°C beyond 7 days from collection.

The fact that the PFOSA results for the spiked field sample analyses at both laboratories are close to the spiked PFOSA amount does not support the presence of PFOSA in the background samples and supports the not-detected results reported by Alpha. The origin of the PFOSA present in the background sample extracts at Vista is not known. Alpha's PFOSA results exhibit better accuracy in the spike samples compared to Vista's results. As such, Alpha is recommended for future site analytical testing based on the results of the spike study.

End of memorandum.