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SUBJECT: NBK Keyport Upland Shallow Soil - Data Summary and Evaluation

INTRODUCTION

This memorandum provides a summary and analysis of chemicals of interest in upland shallow soil within risk assessment Exposure Area 2, Operable Unit 1 (OU 1) at Naval Base Kitsap (NBK) Keyport (Figures 1 and 2). This memorandum is an interim data deliverable that supports the pending overall supplemental remedial investigation report for the site, which is scoped under ESTS Contract N39430-16-D-1802, Task Order N3943018F4359 (PTO X041), and the risk assessment being conducted under separate contract. The site description and background are described in detail in past reports and the sampling and analysis plan (SAP) for the data collection effort (U.S. Navy, 2021), and have not been repeated in this memorandum. Responses to comments received on the draft version of this document are included as an attachment.

This memorandum covers the results of shallow soil sampling conducted throughout Exposure Area 2 and specifically in the vicinity of the former incinerator and burn area located in the northern portion of the landfill (Figure 3). Soil excavated from elsewhere at the Base was stockpiled, at an unknown time prior to 1998, on top of the waste body in the center of Exposure Area 2. Discrete soil samples from this Exposure Area were analyzed for a comprehensive list of analytes, including dioxins and furans, to assess the presence or absence of contaminants of interest (COIs) in support of risk assessment planning. The risk assessment will be submitted under separate cover at a later date.

BOTTOM LINE UP FRONT (BLUF)

The upland shallow soil data indicate that the following COIs are present at concentrations exceeding the project action limits (PALs) from 0 to 6 feet below ground surface (bgs) in soil within Exposure Area 2:

- Polycyclic aromatic hydrocarbons (PAHs) – benzo(a)pyrene, benzo(b)fluoranthene, and benzo(a)anthracene
- Dioxins/Furans – 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
- Polychlorinated biphenyls (PCB) Congeners – Total PCBs and total dioxin-like PCB congeners

- PCB Aroclors – Aroclor-1254 and Total PCB Aroclors
- Total Petroleum Hydrocarbons (TPH) – TPH-diesel range organics (DRO) and TPH-gasoline range organics (GRO)
- Metals – Lead, nickel, arsenic, cadmium, total chromium, zinc, mercury, and hexavalent chromium

These exceedances were identified in both soil representing the upper portion of the former landfill waste body and in the soil mound placed on top of the waste body north of the North Plantation. These results serve primarily as inputs for risk assessment planning in this portion of the site.

SUMMARY OF DATA COLLECTION AND ANALYSIS

Boring Installation and Soil Sampling

Utility locating was performed in advance of direct-push drilling on June 2, 2021, and the Navy issued excavation permit 21-EP067 on June 14, 2021. Direct-push drilling was performed between June 21 and June 23, 2021. Holt Services, of Puyallup, Washington, provided a Geoprobe Model 7822DT track-mounted direct-push drilling rig operated by a driller licensed in Washington State.

Direct-push drilling was performed at 29 locations and continuous cores were obtained using a 5-foot-long, Macro-Core sampler at all locations. Soil borings were advanced to a completion depth of 6 feet bgs. During each boring installation, the first drive of the sampler retrieved a soil core from 0 to 2 feet bgs, then the second drive of the sampler retrieved a soil core from 2 to 6 feet bgs.

Soil from the macro-cores was visually examined for contamination and classified in accordance with the Unified Soil Classification System. Soils were field screened at 1-foot intervals, with a photoionization detector (PID) with readings in parts per billion (ppb). The following procedures were adhered to during PID screening activities:

- Screening took place as soon as possible after each macro-core liner was opened. If screening could not take place immediately after the core was retrieved, the liner was left unopened until screening could be conducted.
- At each screening interval (every foot), a Terra Core sampling device was temporarily pressed into the soil core to isolate a known volume of soil and create a small headspace above the soil volume.
- Tubing from the PID was inserted into the headspace above the soil core.
- The highest value measured on the PID for each measurement interval was recorded.
- A new Terra Core sampler was used for each interval.

Boring logs are included in Attachment 1.

The SAP (U.S. Navy, 2021) specified that "wedge" samples would be collected from each core for analysis of non-volatile analytes and "plug" samples would be collected for volatile analytes (i.e., volatile organic compounds [VOCs] and TPH-GRO). Due to the recovered soil volume and density and consistency of the retrieved soil cores, the wedge procedure was not utilized. Immediately following PID screening, plug soil samples were collected at the depth of highest PID response or from the mid-point of the core if all PID readings of a given core were consistently low to zero. The discrete sampling depths for VOCs and TPH-GRO are indicated on the boring logs (Attachment 1). The plug samples were collected using single-use Terra Core samplers to transfer soil to laboratory-supplied vials. The remaining soil in each core was thoroughly composited by hand mixing in a stainless-steel bowl for sampling for non-volatile analytes. Aliquots of the composited soil were then transferred into the laboratory-supplied containers provided for each of the requested analyses. Soil samples collected from each core (0 to 2 feet bgs and 2 to 6 feet bgs for each boring) were analyzed for the following analytes:

- VOCs
- PAHs
- TPH-DRO, oil range organics [ORO], and GRO)
- PCBs as Aroclors and congeners
- dioxins/furans
- metals, including mercury and hexavalent chromium
- total organic carbon (TOC)
- pH
- per- and poly-fluoroalkyl substances (PFAS)
- moisture content

Soil cuttings were placed in labeled U.S. Department of Transportation (DOT)-approved containers for shipment of solid waste and stored in an area designated by Naval Facilities Engineering Systems Command (NAVFAC) Northwest. The soil borings were abandoned by backfilling the open borehole with hydrated bentonite chips to within 12 inches of ground surface, restoring the surface to match the existing surrounding surface conditions (e.g., grass, soil, or asphalt).

Data summary tables are included in Attachment 2 and document the measured concentrations of COIs compared to PALs.

DATA EVALUATION

This section compares the measured concentrations of COIs to PALs. The PALs presented in this memorandum, some of which differ from the PALs listed in the SAP, are based on values selected by the risk assessment contractor, AECOM, Incorporated. Those instances in which the PALs presented in this memorandum diverge from the SAP are listed in the subsections below. The criteria used for PAL selection are provided in the data summary tables (Attachment 2). Implications of these findings will be assessed under separate contract.

Chlorinated VOCs

The results of target VOCs in soil are summarized in Table 1. Concentrations of vinyl chloride were detected above the limit of detection (LOD) in soil samples collected from borings NP-B170 (2 to 6 feet bgs) and NP-B171 (2 to 6 feet bgs). Concentrations of trichloroethene were detected above the LOD in the soil sample collected from boring NP-B173 (2 to 6 feet bgs).

The PAL for toluene differs from the SAP and is based on Washington Administrative Code (WAC) Table 749-3 (Plants). No VOCs exceeded PALs in any of the soil samples collected for laboratory analysis.

PAHs

The results of PAHs in soil are summarized in Table 2. Concentrations of PAHs were detected above the LOD in 51 of the 58 soil samples collected for laboratory analysis.

The PALs for several PAHs (i.e., acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, and pyrene) differ from the SAP and are based on EPA Ecological Soil Screening Levels (Eco-SSLs). Several PAHs exceeded PALs, which are summarized below:

- Concentrations of benzo(a)pyrene were detected above the PAL (110 micrograms per kilogram [µg/kg]) in soil samples collected from borings NP-B153 (0 to 2 feet bgs), NP-B154 (0 to 2 feet bgs), NP-B161 (2 to 6 feet bgs), NP-B166 (2 to 6 feet bgs), NP-B167 (2 to 6 feet bgs), and NP-B171 (2 to 6 feet bgs) with the highest concentration found at NP-B166 (2 to 6 feet bgs) at 2,200 µg/kg.
- Concentrations of benzo(b)fluoranthene were detected above the PAL (1,100 µg/kg) in soil samples collected from borings NP-B161 (2 to 6 feet bgs) [1,400 µg/kg] and NP-B166 (2 to 6 feet bgs) [2,100 µg/kg].
- Benzo(a)anthracene was detected above the PAL (1,100 µg/kg) in the soil sample collected from boring NP-B166 (2 to 6 feet bgs) [3,300 µg/kg].
- Concentrations of carcinogenic PAH (e.g., benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene) toxic equivalency (TEQ) values were detected above the PAL (110 µg/kg) in the soil samples collected from 19 of the 58 soil samples collected for laboratory analysis, with non-detect (ND) values counted as full values (i.e., equal to LOD). Eight of these 19 PAL exceedances did not exceed the PAL if ND values were counted as zero (see Table 2).

In the field duplicate pair from boring NP-B166, the total PAH TEQ concentration measured in the parent versus the duplicate sample varied by an order of magnitude. This result highlights the typical heterogenous distribution of this chemical in soil.

Dioxins/Furans

The results of dioxins/furans in soil are summarized in Table 3. Concentrations of dioxins/furans were detected above the LOD in 58 of the 58 soil samples collected for laboratory analysis.

The PAL for 2,3,7,8- TCDD differs from the SAP and is based on the Washington Soil Natural Background value (Puget Sound). The concentration of 2,3,7,8- TCDD was detected above the PAL (5.2 picograms per gram [pg/g]) in the soil sample collected from boring NP-B169 (2 to 6 feet bgs) [25 pg/g].

PCB Congeners

The results of PCB congeners in soil are summarized in Table 4. Concentrations of PCB congeners were detected above the LOD in 58 of the 58 soil samples collected for laboratory analysis.

The PALs presented in this memorandum for PCB congeners are consistent with the SAP. Concentrations of total dioxin-like PCB congener TEQ values were detected above the PAL (4.8 pg/g) in soil samples collected from borings NP-B154 (2 to 6) [5.82 pg/g], NP-B167 (0 to 2 feet bgs) [10.6 pg/g], and NP-B172 (2 to 6 feet bgs) [14.5 pg/g], with ND values counted as full values. Only one soil sample, NP-B167 (0 to 2 feet bgs), exceeded the PAL if ND values were counted as zero (see Table 4).

Concentrations of Total PCBs were detected above the PAL (230,000 pg/g) in soil samples collected from borings NP-B146 (0 to 2 feet bgs), NP-B154 (2 to 6 feet bgs), NP-B161 (2 to 6 feet bgs), NP-B166 (2 to 6 feet bgs), NP-B167 (0 to 2 feet bgs), NP-B169 (2 to 6 feet bgs), and NP-B172 (2 to 6 feet bgs), with ND values counted as either full values or as zero (see Table 4). Additionally, the PCB congener PCB-118 exceeded its individual PAL in boring NP-B167 (0 to 2 feet bgs).

PCB Aroclors

The results of PCB Aroclors in soil are summarized in Table 5. Concentrations of PCB Aroclors were detected above the LOD in 14 of the 58 soil samples collected for laboratory analysis.

The PALs for Aroclor-1016 and Aroclor-1254 differ from the SAP and are based on EPA Residential Regional Screening Levels (RSLs) with a target hazard quotient (THQ) equal to 0.1. Concentrations of Aroclor-1254 were detected above the PAL (120 µg/kg) in soil samples collected from borings NP-B146 (0 to 2 feet bgs) [130 µg/kg], NP-B149 (2 to 6 feet bgs) [180 µg/kg], NP-B154 (2 to 6 feet bgs) [140 µg/kg and 3300 µg/kg in parent sample and field duplicate, respectively], NP-B160 (2 to 6 feet bgs) [200 µg/kg], NP-B161 (2 to 6 feet bgs) [920 µg/kg], and NP-B162 (2 to 6 feet bgs) [130 µg/kg]. Concentrations of Total PCB Aroclors were detected above the PAL (230 micrograms per kilogram [µg/kg]) in soil samples collected from borings NP-B154 (2 to 6 feet bgs) and NP-B161 (2 to 6 feet bgs).

In the field duplicate pair from boring NP-B154, the Aroclor 1254 concentration measured in the parent versus the duplicate sample varied by more than an order of magnitude. Additionally, the sampling results for PCB congeners do not directly correlate with the sampling results for PCB Aroclors. Both of these occurrences highlight the typical heterogenous distribution of this chemical in soil.

Per- and Polyfluoroalkyl Substances

The results of PFAS in soil are summarized in Table 6. Concentrations of PFAS compounds were detected above the LOD in 54 of the 58 soil samples collected for laboratory analysis.

The PALs for perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorohexanoic acid (PFHxA) differ from the SAP and are based on the lowest values of those presented in Divine et al. (2020), EPA Residential RSLs (ASD, 2022), and Conder et al. (2020), respectively. No PFAS compounds exceeded PALs in any of the soil samples collected for laboratory analysis.

The PALs included in this memorandum are the most up to date criteria as specified by DoD guidance. Considering the rapid evolution of PFAS regulations, data may be re-evaluated in the future based on a comparison to other screening levels promulgated at a later date, should vetted and appropriate screening levels become available in the future.

TPH

The results of TPH in soil are summarized in Table 7. Concentrations of TPH-DRO, TPH-ORO, and TPH-GRO were detected above the LOD in 36, 36, and 13 of the 58 samples, respectively, collected for laboratory analysis.

The PALs presented in this memorandum for TPH are consistent with the SAP. Concentrations of TPH-DRO were detected above the PAL (2,000,000 µg/kg) in the soil sample collected from boring NP-B172 (2 to 6 feet bgs) [2,200,000 µg/kg]. Concentrations of TPH-ORO were detected above the PAL (2,000,000 µg/kg) in soil samples collected from boring NP-B149 (2 to 6 feet bgs) [2,200,000 µg/kg], NP-B154 (2 to 6 feet bgs) [2,300,000 µg/kg], NP-B171 (2 to 6 feet bgs) [2,600,000 µg/kg], and NP-B172 (2 to 6 feet bgs) [4,500,000 µg/kg]. Concentrations of TPH-GRO were detected above the PAL (30,000 µg/kg) in the soil sample collected from NP-B171 (2 to 6 feet bgs) [310,000 µg/kg]. However, none of the BTEX analytes were detected above the reporting limits in this sampling, implying an aged gasoline.

Metals

The results of metals in soil are summarized in Table 8. Concentrations of all metals tested, with the exception of mercury and hexavalent chromium, were detected above the LOD in 58 of the 58 samples collected for laboratory analysis.

The PALs for all metals, with the exception of total chromium and hexavalent chromium, differ from the SAP and are based on Washington Soil Natural Background values (arsenic, nickel, zinc, and mercury) and WAC Table 749-3 (Plants) [beryllium, cadmium, and lead]. Several metals exceeded PALs, which are summarized below:

- Concentrations of lead were detected above the PAL (50 milligrams per kilogram [mg/kg]) in soil samples collected from borings NP-B154 (2 to 6 feet bgs), NP-B162 (2 to 6 feet bgs), NP-B163 (0 to 2 feet bgs), NP-B164 (2 to 6 feet bgs), NP-B166 (2 to 6 feet bgs), NP-B167 (0 to 2 feet bgs), NP-B169 (2 to 6 feet bgs), and NP-B172 (2 to 6 feet bgs). Concentrations range from 50.1 to 659 mg/kg with the highest concentration at NP-154 (2 to 6 feet bgs).

- Concentrations of nickel were detected above the PAL (38.2 mg/kg) collected in 36 of the 58 samples (26 of the 29 boring locations) collected for laboratory analysis. Concentrations range from 38.5 to 958 mg/kg with the highest concentration at NP-B154 (2 to 6 feet bgs).
- Concentrations of arsenic were detected above the PAL (7.3 mg/kg) in soil samples collected from borings NP-B149 (0 to 2 and 2 to 6 feet bgs), NP-B152 (0 to 2 feet bgs), NP-B167 (0 to 2 feet bgs), NP-B170 (2 to 6 feet bgs), and NP-B172 (2 to 6 feet bgs). Concentrations range from 8.2 to 18.2 mg/kg with the highest concentration at NP-152 (0 to 2 feet bgs).
- Concentrations of cadmium were detected above the PAL (4 mg/kg) in soil samples collected from borings NP-B154 (2 to 6 feet bgs) [4.4 mg/kg], NP-B167 (0 to 2 feet bgs) [8.3 mg/kg], and NP-B172 (2 to 6 feet bgs) [9.7 mg/kg].
- Concentrations of total chromium were detected above the PAL (0.3 mg/kg based on hexavalent chromium) in 58 of the 58 the samples collected for laboratory analysis. Concentrations range from 21.4 to 583 mg/kg with the highest concentration at NP-B167 (0 to 2 feet bgs).
- Concentrations of zinc were detected above the PAL (85 mg/kg) in soil samples collected from borings NP-B148 (0 to 2 feet bgs), NP-B149 (0 to 2 and 2 to 6 feet bgs), NP-B152 (0 to 2 feet bgs), NP-B153 (0 to 2 feet bgs), NP-B154 (2 to 6 feet bgs), NP-B156 (2 to 6 feet bgs), NP-B160 (2 to 6 feet bgs), NP-B163 (0 to 2 feet bgs), NP-B164 (2 to 6 feet bgs), NP-B166 (2 to 6 feet bgs), NP-B167 (0 to 2 feet bgs), NP-B169 (2 to 6 feet bgs), NP-B170 (2 to 6 feet bgs), and NP-B172 (0 to 2 and 2 to 6 feet bgs). Concentrations range from 100 to 6,050 mg/kg with the highest concentration at NP-B172 (2 to 6 feet bgs).
- Concentrations of mercury were detected above the PAL (0.07 mg/kg) in soil samples collected from borings NP-B146 (0 to 2 feet bgs), NP-B148 (0 to 2 feet bgs), NP-B150 (0 to 2 feet bgs), NP-B160 (2 to 6 feet bgs), NP-B164 (2 to 6 feet bgs), NP-B166 (2 to 6 feet bgs), NP-B167 (0 to 2 feet bgs), NP-B169 (2 to 6 feet bgs), and NP-B172 (2 to 6 feet bgs). Concentrations range from 0.073 to 10.8 mg/kg with the highest concentration at NP-B169 (2 to 6 feet bgs).
- Concentrations of hexavalent chromium were detected above the PAL (0.3 mg/kg) in soil samples collected from borings NP-B148 (0 to 2 feet bgs), NP-B152 (0 to 2 feet bgs), NP-B153 (2 to 6 feet bgs), NP-B155 (0 to 2 and 2 to 6 feet bgs), NP-B156 (0 to 2 and 2 to 6 feet bgs), NP-B162 (2 to 6 feet bgs), NP-B164 (2 to 6 feet bgs), NP-B165 (0 to 2 feet bgs), NP-B166 (0 to 2 and 2 to 6 feet bgs), NP-B167 (0 to 2 feet bgs), NP-B168 (0 to 2 and 2 to 6 feet bgs), and NP-B169 (2 to 6 feet bgs). Concentrations range from 0.33 to 18 mg/kg with the highest concentration at NP-B166 (2 to 6 feet bgs).

TOC

The results of moisture content, TOC, and pH are summarized in Table 9. In the 58 soil samples, TOC concentrations ranged from 1,000 mg/kg to 23,000 mg/kg and pH values ranged from 5.55 to 11.15, with one pH value less than 6.0 and five pH values greater than 8.0.

QUALITY ASSURANCE/QUALITY CONTROL

All samples were collected and analyzed in accordance with EPA methods stated in the *Final Sampling and Analysis Plan (SAP) for Keyport OU1 PCB and Upland Soils Investigation, Naval Base Kitsap, Keyport, Washington* (U.S. Navy, 2021).

Samples were shipped via overnight courier under chain-of-custody documentation to the designated analytical laboratories for analysis. Eurofins TestAmerica, located in West Sacramento, California, analyzed soil samples for PCB congeners. The same soil samples were analyzed by Eurofins TestAmerica in Seattle, Washington for TOC. Soil samples were also analyzed for PFAS by Battelle's Norwell, Massachusetts laboratory. All other analytical testing on soils was conducted by APPL, Inc., in Clovis, California. Tests included: VOCs; PCB Aroclors; metals; mercury; hexavalent chromium; PAHs; gasoline, diesel, and oil range TPH; pH; and dioxins/furans. The analytical laboratories were required to maintain certification from the Department of Defense Environmental Laboratory Accreditation Program for the analytical methods performed on the samples, where applicable.

Laboratory quality assurance (QA) oversight involved the performance of a first-level screening of the data and an indication of any deviations from their precision, accuracy, detection limit, or laboratory QA/quality control (QC) criteria. A representative from each laboratory signed the data sheets, ensuring that the screening described above had been completed. Subsequently, Battelle performed a completeness review of the data by comparing the analyses requested for each sample on the chain-of-custody form with the database results for that sample. The analytical data, along with the associated laboratory QC information, were then forwarded to an independent, third-party data validation service, Laboratory Data Consultants for validation, as follows. A Stage 2A data validation was performed on metals, mercury, hexavalent chromium, TPH-gasoline, TPH-diesel, TPH-oil, and pH analyses. A Stage 3 data validation was performed on TOC analysis. All other parameters and samples were subject to a Stage 4 data validation process.

Results from the sampling event indicated that the data generally met analytical criteria. However, there were exceptions to the analytical criteria noted in the laboratory data validation reports. Exceptions to the analytical criteria are detailed in the sections below, by matrix (e.g., soil, sediment) and analytical group.

Exceptions to the analytical criteria resulted in the assignment of "J" or "U" qualifiers to the data. The "J" qualifier indicates that the result is considered an estimated value. The "U" qualifier indicates that the result is not detected due to contamination or interference. No data were rejected in this dataset.

During sampling, field duplicate QC samples were collected for all parameters in soil samples to evaluate reproducibility and ensure that a meaningful and representative dataset was generated for the Keyport OU1 upland soil investigation. Per the SAP, the goal was to collect field duplicate samples at a rate of 5% (1 per 20) of sample locations per matrix and parameter. Fifty-eight (58) soil samples were collected, and three field duplicates were collected and analyzed for all parameters (>7%). Field duplicates were collected at NP-B154-S2-6 (labeled as NP-B154-S4), NP-B166-S2-6 (labeled as NP-B166-S4), and NP-B170-S2-6 (labeled as NP-B170-S4).

Field duplicate relative percent difference (RPD) criteria for soil samples is less than or equal to (≤) 50%. All field duplicates for all parameters met these criteria except for: PCB Aroclors, metals, and furans in the duplicate pairs NP-B154-S2-6/NP-B154-S4 and NP-B166-S2-6/NP-B166-S4; and PAHs, metals, TPH-diesel, and TPH-oil in the duplicate pair NP-B170-S2-6/NP-B170-S2-6. Additional details are given below. Results for these analytes and samples should be considered estimates.

Review of the laboratory data and data validation confirmed that the measurement quality objectives were achieved, and data are acceptable for use. Data validation qualifiers used in the data set are:

- J – Estimated: The analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformance discovered during data validation.
- U – Non-detected: The analyte was analyzed for and positively identified by the laboratory; however, the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ – Non-detected estimated: The analyte was reported as not detected by the laboratory; however, the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

Except where otherwise stated, the data associated with all of the issues identified below were qualified as estimated using either the qualifier "J" where the analyte was detected above the laboratory limit of quantitation (LOQ, which is equivalent to the practical quantitation limit [PQL]), or "UJ" where the analyte was not detected above the laboratory LOD.

Soil

Chlorinated VOCs

- The holding time requirement of 14 days for VOC analysis was exceeded for all soil samples by 2 to 5 days. Laboratory capacity, resources, and instrument issues resulted in the missed holding times. All VOC data were estimated.
    - The VOC data remain useable for the project objectives because the data are to be used for screening the contaminants present in Exposure Area 2 to allow risk assessment planning.
- The initial calibration percent relative standard deviation (%RSD) criteria were exceeded for chloroethane and vinyl chloride, affecting nine samples.
- The matrix spike/matrix spike duplicate (MS/MSD) percent recovery (%R) for six out of 14 VOCs were outside of the acceptable range for NP-B154-S2-6-210622.
- The MS/MSD %R for ethyl benzene and total xylenes was outside of the acceptable range for NP-B172-S2-6-210623.

PAHs

- The MS/MSD %R for six out of 18 PAHs was outside of the acceptable range for NP-B170-S2-6-210623.
- Surrogate spike %R was outside of the acceptable range in seven soil samples out of 61 total soil samples (58 plus three field duplicates) [11%]. All analytes were estimated.
- Thirteen out of 18 analytes were outside acceptance RPD of ≤50% for field duplicates. The sample and duplicate pair (NP-B166-S2-6 and NP-B166-S4) were estimated.

Dioxins/Furans

- Dioxins/furans were detected in five different soil laboratory blanks at trace levels (less than the reporting limits). Sample concentrations were compared to concentrations detected in the laboratory blanks. If sample concentrations were not significantly greater than five times (>5X) the blank concentrations, the sample concentrations were considered to be non-detect or estimated. OCDD and 1,2,3,4,6,7,8-HpCDD were identified in two to five soil samples, respectively, which resulted in reporting results as ND at the reported concentrations. Total homologues were identified in two to 13 soil samples per incidence, which were estimated.
- Dioxins/furans were detected in three field blanks and the source blank at trace levels (less than the reporting limits). TCDD and TCDF were detected above the reporting limit in EB-210622-01. Sample concentrations were compared to concentrations detected in the field blanks. If sample concentrations were not significantly greater than five times (>5X) the blank concentrations, the sample concentrations were considered to be estimated for TCDD, TCDF, HxCDF, HpCDD, and HpCDF in four to 14 samples. 1,2,3,4,6,7,8-HpCDF in one sample was reported as ND at the reported concentration.
- The continuing calibration verification (CCV) standard percent difference (%D) criteria were exceeded for seven analytes, affecting two samples (NP-B171-S2-6-210623 and NP-B172-S2-6-210623).
- Laboratory control sample (LCS) %R for 1,2,3,4,7,8,9-HpCDF was outside of the acceptable range biased high affecting one soil sample (NP-B171-S0-2-210623).
- LCS %R for 1,2,3,7,8,9-HxCDF and 2,3,4,6,7,8-HxCDF were outside of the acceptable range biased low affecting two soil samples (NP-B171-S2-6-210623 and NP-B172-S2-6-210623).
- The MS/MSD %R was outside of the acceptable range for NP-B154-S2-6-210622 (three out of 25 analytes) and NP-B172-S2-6-210623 (4 out of 25 analytes). The MS/MSD %RPD acceptance limits were exceeded for the same samples for two and one analytes, respectively.

- Labeled compound recoveries were outside acceptance criteria in two soil samples (NP-B171-S2-6-210623 and NP-B172-S2-6-210623) resulting in estimating two and three analytes, respectively.
- Total HpCDF and total TCDF were outside acceptance RPD of ≤50% for field duplicates. The sample and duplicate pair (NP-B154-S2-6 and NP-B154-S4) were estimated.

PCB Congeners

- PCB-congeners were detected in six soil laboratory blanks at trace levels (less than the reporting limits), except for PCB-3 detected in two blanks, which were greater than the reporting limits. Sample concentrations were compared to concentrations detected in the laboratory blanks. If sample concentrations were not significantly greater than five times (>5X) the blank concentrations, the sample concentrations were considered to be non-detect. Twenty-four PCB analytes were identified in three to 53 soil samples, which resulted in reporting results as non-detect at the reported concentrations.
- MS/MSD %R and %RPDs for different PCB congeners (NP-B170-S2-6-210623 [3%Rs and 2%RPDs]; NP-B154-S4-210622 [3%Rs and 1%RPD]; NP-B172-S2-6-210623 [7%Rs and 4%RPDs]) were outside of the acceptable range. Analytes in these samples were estimated.
- One or two labeled compound recoveries were outside acceptance criteria in six soil samples. Associated analytes (nine to 29) were qualified as estimated.
- The ion abundance ratio for one to four labeled compounds used to quantitate target analytes was outside acceptance criteria in nine soil samples. Associated analytes (2 to 50) were qualified as estimated.

PCB Aroclors

- The CCV standard %D criteria was exceeded for PCB-1016 or 1260 in six analytical batches, affecting all PCB Aroclors except for PCB-1254, affecting 32 out of 61 samples (52%).
- The MS/MSD %R for PCB-1260 was outside of the acceptable range for NP-B172-S2-6-210623.
- Surrogate spike %R was outside of the acceptable range in two soil samples (NP-B170-S2-6-210623 and NP-170-S4-210623). All analytes are estimated.
- PCB-1254 and Total PCBs were outside acceptance RPD of ≤50% for field duplicates. The sample and duplicate pair (NP-B154-S2-6 and NP-B154-S4) were estimated.
- PCB compound quantitation criteria are evaluated during validation and where the quantitation of detected compounds differs between two gas chromatographic columns by more than 40 RPD, the results are considered estimated. PCB-1254

detected in six samples was qualified due to compound quantitation criteria not being met.

Per- and Polyfluoroalkyl Substances

- Labeled compound recoveries were outside acceptance criteria in five soil samples, resulting in estimating four analytes.

TPH-Gasoline

- The TPH-gasoline result exceeded the calibration curve for sample NP-B171-S2-6-210623, therefore, the result was qualified as estimated.

TPH-Diesel and Oil

- The MS/MSD %R for TPH-diesel and TPH-oil were outside of the acceptable range in sample NP-B170-S2-6-210623. Additionally, the %RPD was outside the acceptance range for TPH-diesel in the same sample.
- The surrogate spike %R for TPH-diesel and TPH-oil were outside of the acceptable range affecting one soil sample (NP-B154-S0-2-210622).
- TPH-diesel and TPH-oil were outside acceptance RPD of ≤50% for field duplicates. The samples and duplicate pairs (NP-B166-S2-6/NP-B166-S4 and NP-B170-S2-6/NP-B170-S4) were estimated.

Total Organic Carbon (TOC)

- All data met criteria.

Metals and Mercury

- The holding time requirement of 28 days for mercury analysis was exceeded for 12 soil samples by 1 day. The mercury data were estimated.
- MS/MSD %R and %RPDs for different metals (NP-B154-S2-6-210622 [5%Rs and 4%RPDs]; NP-B164-S0-2-210622 [5%Rs]; NP-B170-S2-6-210623 [2%Rs and 1%RPD]; and NP-B172-S2-6-210623 [2%Rs and 2%RPDs]) were outside of the acceptable range. Analytes in these samples were estimated.
- All three field duplicates had metals which exceeded RPD of ≤50% acceptance limits. Sample and duplicate pair exceedances are as follows: NP-B154-S2-6/NP-B154-S4 (cadmium and nickel); NP-B166-S2-6/NP-B166-S4 (lead and zinc); and NP-B170-S2-6/NP-B170-S4 (cadmium, chromium, lead, and zinc).
- The serial dilution of lead in sample NP-B164-S0-2-210622 exceeded method criteria, indicating matrix interference.

Hexavalent Chromium

- The holding time requirement of 30 days for hexavalent chromium analysis was exceeded for 20 soil samples by 4 days and for 21 samples by 11 to 12 days. These data were estimated.
- Hexavalent chromium was detected in one of the three field blanks at a trace level (less than the reporting limit). Sample concentrations were compared to concentrations detected in the field blank. If sample concentrations were not significantly greater than five times (>5X) the blank concentrations, the sample concentrations were considered to be ND. Hexavalent chromium was reported as ND at the reported concentrations in four soil samples.
- MS/MSD %R and %RPDs were outside the acceptable range for NP-B154-S2-6-210622, NP-B154-S4-210622, NP-B170-S2-6-210623 (%R only), and NP-B172-S2-6-210623.

As indicated above, no data were rejected. Only estimations of data were made for holding time exceedances, blank contamination, calibration uncertainty, LCS recovery exceedances, MS/MSD %R and/or RPD exceedances, labeled compound and/or surrogate recovery exceedances, field duplicate imprecision, and other matrix-related failures. Although APPL had several issues with holding times and delays in providing the sample results, the overall quality of the data met the data requirements of the project. All other data were acceptable and meet data quality objectives (DQOs) for this project.

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FIGURES

ATTACHMENTS

ATTACHMENT 1: BORING LOGS

ATTACHMENT 2: TABULATED DATA

ATTACHMENT 3: RESPONSES TO COMMENTS ON DRAFT VERSION