|  |  |
| --- | --- |
| **To:** | Brian Schumacher and John H. Zimmerman, Office of Research and Development, National Exposure Research Laboratory, Las Vegas, NV; Durham, NC. |
| **From:** | Robert Truesdale and Linda Andrews, RTI International, Durham, NC; Chris Lutes and John Lowe, Jacobs Engineering; Bo Stewart, PRAXIS Environmental Technologies. |
| **Date:** | August 31, 2018 |
| **Subject:** | Project Database, STREAMS 3, TO 03, Soil Vapor Extraction (SVE) for Vapor Intrusion (VI) |

The Task Order 03 database was assembled to contain the current and up-to-date data supporting the current and future analyses and reporting requested by EPA under their “SVE for VI Pilot – Phase II”. This STREAMS 3 project has run since May 2017, with the base period ending on November 8, 2018. Prior to this project RTI performed predecessor work for EPA under Task order 28 of the STREAMS II contract from January 2016 to date. Together these projects produced the following datasets submitted with this memo:

* More than two years (1/15/2016 - 4/27/2018) of volatile organic compound (VOC) data from subslab and exterior soil gas probes, indoor and outdoor air samplers, and groundwater wells (15,556 records): *SVE-VI\_TO-03\_VOC-Results\_08-31-18.xlsx*
* Almost two years (4/8/2016 – 2/5/2018) of subsurface vacuum readings collected from 12 subslab probes and 25 exterior soil gas probes (692 records):

*SVE-VI\_TO-03\_Vacuum\_Readings\_08-31-18.xlsx*

* Two years (3/4/2-16 – 3/13/2018) of pressure differential data from 12 automated subslab–to-indoor air differential pressure probes (506,564 records):

*SVE-VI\_TO-03\_Pressure\_Data\_8-31-18.xlsx*

**Exhibit 1** provides the schedule of the basic project stages and sampling efforts. Beginning Spring of 2016, we began collecting baseline data on VOCs in groundwater, exterior soil gas, subslab soil gas, indoor air, and outdoor air. Following installation and start-up of the Phase 1 SVE system in late March of 2016, sampling expanded to include system monitoring using sampling ports in the SVE system manifolds, including the SVE system influent and effluent. The system was operated from early April through June 28, at which point the SVE was turned off for rebound testing. This first round of rebound testing extended from July 1 through September 16, 2016, at which point the Phase 1 SVE system was turned back on. In late November and early December 2016, Phase 2 modifications were made to the system with the new wells being logged with the Pneulog system on December 14-15, 2016. Following installation and step testing, the expanded (Phase 2) system was operated from December 20 through January 20, 2017, at which point the system was shut down for a second rebound test through June 12. After Rebound 2, several modifications were made to the system to improve VOC extraction efficiency and reach, including changes to overcome stratigraphic limitations to SVE. The system was shut off March 1, 2018, for a third rebound test that continues at the time of this memo.

Exhibit 1. General SVE-VI Project Schedule, Phases, and Sampling Efforts

|  |
| --- |
| Baseline Sampling – January 15 – April 4, 2016  Soil gas, indoor air, and subslab sampling  Subslab and indoor air installed – January 19-22, 2016 |
| Phase 1 Soil Vapor Extraction (SVE) Wells (3) installed – February 3-5, 2016 |
| Phase 1 SVE Operation – April 5 – June 28, 2016 Step testing – April 5–8 Two deep screen operation – April 8-20 Six screen operation – April 20-26 Nine screen operation – April 26 - May 24 Various combinations of screens in operation – May 24 to June 28 |
| First Rebound Test – July 1 – September 16 |
| Phase 1A1 SVE Operation – September 17 – December 15 |
| Phase 2 subslab probe installation and baseline sampling – November 10 – December 1, 2016 |
| Phase 2 SVE wells and soil gas probes installed – December 1-15, 2016 |
| Phase 22 SVE Operation – December 12, 2016 – January 20, 2017   (step testing December 12 to December 20) |
| Second Rebound Test – January 19 – June 12, 2017 |
| Phase 2A SVE Operation – June 12, 2017 – March 1, 2018 Add WSVE1-10, increase total flow – June 30 Increase total flow – August 2 Add venting (MW 03) – November 8 Terminate WSVE 1-10 & Vent – January 8, 2018 Terminate BSVE2R-12; add MW03 – February 5System Shutoff for Third Rebound Test March 1 |
| Third Rebound Test – March 2018 - (To Be Determined) |

1 Extraction system modified based on Phase 1 results

2 Phase 1A plus new Phase 2 SVE wells

**Volatile Organic Compound (VOC) Data**

Several laboratories, using differing analytical methods, produced the TO 28 VOC data. **Exhibit 2** lists these laboratories, the kind of samples they analyzed, and what analytical methods were used. The available results from each lab are included in the “VOC\_Results” worksheet in the attached workbook (“SVE-VI\_TO-03\_VOC-Results\_08-31-18.xlsx”). This workbook contains a data dictionary worksheet (Dictionary) that describes the content of each results data field and a lookup table that explains the analytical (QA/QC) flags used in the “results\_codes” field of the database (“Results\_Notes QA Flags). Exhibits 3 and 4 below are the same VOC data dictionary and QA flag lookup table.

Exhibit 2. Analytical Laboratories Used in STREAMS 3 Task Order 03

|  |  |  |
| --- | --- | --- |
| **Laboratory** | **Media and Sample Analyzed** | **Analytical Methods Used** |
| EPA ORD EMSL1 Las Vegas, NV | External & subslab soil gas (active ATD tube sample); indoor & outdoor air samplers (passive Radiello 145) | Modified EPA Method TO-17 |
| ALS Environmental, Simi Valley, CA |
| EPA Region 9, San Francisco, CA | External soil gas, outdoor air, SVE system (Summa canister); indoor air samplers (passive Radiello 130) | EPA Method TO-15 (Summas); Modified EPA Method TO-17 (Radiellos) |
| Praxis Environmental, Burlingame, CA | External and subslab soil gas, SVE system (Tedlar bag) | Modified EPA Method 18 |

1 U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring Systems Laboratory

Exhibit 3. General VOC Database Dictionary

| **Field** | **Description** |
| --- | --- |
| sys\_loc\_code | Unique location ID (station ID + probe depth) |
| sample\_purpose | "Duplicate", "Field blank", or "normal" |
| begin\_date | Date sample collection began |
| begin\_time | Time sample collection began |
| end\_date | Date sample collection ended |
| end\_time | Time sample collection ended |
| duration\_min | Sample duration (min); "0" for grab samples) |
| sample\_volume\_L | Volume of sample (L) |
| PL\_depth\_ft | Depth of PneuLog measurements (PneuLog samples only) |
| sample\_type | "External", "Indoor", "Outdoor", "Field blank", "Ground water", "Soil gas", "Subslab", "SVE" |
| sample\_matrix | matrix sampled: "Air", "Ground water", "Soil gas" |
| sorbent\_media | sampler type: "Active ATD Tenax TA", "Disposable bailer", "Passive Radiello 130 SE", "Passive Radiello 145 TD", "PDB", "Summa Canister", "Tedlar Bag" |
| sampler | Person or firm who took sample |
| tube\_id | Tube or sampling device ID (as available) |
| lab\_sample\_id | Unique sample ID used by laboratory |
| lab\_name | Name of analytical laboratory |
| lab\_request\_id | Unique ID for batch of samples (e.g., COC) |
| analysis\_method | Chemical analysis method: "EPA Method 8260B", "Method TO-15", "Modified Method TO-17", "Modified Method 18"  |
| test\_type | "Initial", "Dilution", "Reanalysis" (R9 samples only) |
| date\_analyzed | Date sample was analyzed |
| casnum | Chemical Abstracts Service Registry Number |
| compound\_name | Chemical name |
| result\_value | Analytical results |
| result\_units | Results units |
| ND\_flag | Binary flag for nondetect (1) or detection (0) |
| result\_notes | Results flags (U, J, O, C, etc.; see Results\_notes QA Flags table) |
| percent\_recovery | percent recovery of added standard (as appropriate) |
| comments | Comments on sample collection or analysis |

Exhibit 4. VOC Results Flag Definitions

| **Flag** | **Definition** |
| --- | --- |
| B | compound present in laboratory blank greater than reporting limit (and no background subtraction) |
| C | associated calibration verification standard failed project QC criteria |
| D | compound identified in an analysis at a secondary dilution factor |
| E | estimated value above highest calibration standard concentration |
| H | the analyte in question was quantitated using peak heights rather than peak areas for both the analyte and its internal standard. |
| I | associated internal standard failed project QC criteria |
| J | estimated value above method detection limit but below reporting/quantification limit |
| NA | no flag |
| O | Interference, compound could not be quantified because another compound overlapped. |
| Q | value failed project QC criteria |
| R | rejected - the result was rejected due to a quality control issue (compound may or may not be present) |
| S | associated surrogate standard failed project QC criteria |
| T | analyte peak was truncated |
| U | not detected (analysis below method detection limit) |
| ND | not detected (analysis below method detection limit) |

**Differential Pressure and Vacuum Data**

In addition to the VOC data, the project collected both subslab to indoor air differential pressure data to see how this VI driving force was influenced by SVE system operation, and vacuum measurements at different subsurface and subsoil locations to measure and quantify the subsurface pressure field at the site. These data are included as attachments to this submittal, SVE-VI\_TO-03\_Pressure\_Data\_8-31-18.xlsx and SVE-VI\_TO-03\_Vacuum\_Readings\_08-31-18.xlsx, respectively. Each of these files contains a data dictionary (**Exhibit 5** and **Exhibit 6**).

Exhibit 5. SVE-VI Differential Pressure Database Data Dictionary

|  |  |
| --- | --- |
| **Field** | **Description** |
| sys\_loc\_code | unique location ID (station ID) |
| date | date measurement made |
| time | time measurement made |
| ambient\_temp\_C | ambient temperature during measurement (degrees Centigrade) |
| pressure\_inH2O | measured pressure (inches water column) |
| pressure\_Pa | measured pressure (Pascal) |

Exhibit 6. SVE-VI Vacuum Readings Database Data Dictionary

|  |  |
| --- | --- |
| **Field**  | **Description** |
| sys\_loc\_code | Unique location ID (station ID) |
| depth\_ft | probe depth in feet |
| sample\_date | date measurement made |
| flow\_scfm | flow in standard cubic feet per minute |
| before/after | before or after configuration or extraction rate change |
| vacuum\_response | measured vacuum (inches of water) |

**Quality Assurance/Quality Control (QA/QC)**

All data reported in this database was subject to the requirements of the Quality Assurance Project Plan (QAPP) prepared under the previous project (STREAMS II TO 28) and reviewed and followed under this project (STREAMS 3 TO 03). In addition, the Task Order was subjected to an EPA quality assurance audit (QAA) on August 2, 2017. The QAA was successfully completed by the TOCOR and alternate TOCOR, who stated: *“Overall, we were very pleased with the quality, efficiency, and knowledge of the required procedures displayed by the various samplers/ sampling teams. We feel confident that the samples collected are of high quality and will meet the needs of the research program.”*

**Reference**

U.S. EPA (Environmental Protection Agency). 2015. Soil Vapor Extraction Pilot Study to Prevent Vapor Intrusion - Quality Assurance Project Plan – Final. Category III. Office of Research and Development, Las Vegas, NV, and Region 9, San Francisco, CA**.**